Voting System Qualification Test Report

Elections Systems & Software, LLC

EVS Release 4.5.0.0, Version 4

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Florida Department of State
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Executive Summary

Elections Systems & Software, LLC (ES&S) submitted an application requesting Florida certification of the *EVS Release 4.5.0.0, Version 4* voting system. ES&S's request includes various optimization and performance enhancements of previously certified systems, as well as the introduction of the ExpressVote marking device.

The current Florida certified voting system includes an election management system known as ElectionWare; a precinct scanner (DS200); a precinct ballot marking device that can be used by voters with disabilities (AutoMARK); and a central count scanner (DS850). Precinct results may be uploaded to the election management system manually, or via wireless or landline modems.

This certification introduces a new device to Florida voters with disabilities. The ExpressVote is a vote capture device with a verifiable paper record that is digitally scanned for tabulation. This system combines paper-based voting with touch screen technology. The ExpressVote includes a mandatory vote summary screen that requires voters to confirm or revise their selections prior to printing the summary of ballot selections using the internal thermal printer. Once printed, ES&S ballot scanners process the vote summary card. The ExpressVote is designed to serve all voters, but the *EVS Release 4.5.0.0, Version 4* application request is for use only by voters with disabilities. ES&S has fully integrated the ExpressVote with the existing suite of ES&S voting system products.

The Division of Elections' Bureau of Voting Systems Certification (BVSC) conducted the certification testing in two phases. Phase I consisted of verifying the setup of the two configurations of the election management system, restoration/import of two elections (general and primary elections), creation of two elections (municipal and Presidential Preference Primary elections), a physical audit, and a functional audit. Phase II encompassed the conduct of mock elections and election cycle events, such as loading the tabulators with the requisite media, opening and closing of polls, feeding ballots, central count tabulation, and election night and post-election reporting. BVSC performed tests to verify compliance with standards for sound pressure levels and contest recounts, conducted mass ballot count testing for the central count scanner and the precinct scanner, and conducted additional tests as necessary to observe the voting system's capabilities.

The ES&S ExpressVote represents new technology in a voting system specifically for use by Florida voters with disabilities. For example, the system introduces a vote summary card (in lieu of a traditional ballot card) upon which is imprinted only the voter's selections in all contests on a ballot, all contest titles and a corresponding barcode to be "read" by the tabulator. BVSC finds that with future enhancements, the system could provide greater independence for persons with disabilities. However, in its current form, BVSC has identified several areas affecting usability and functionality that warrant enhanced documentation, procedures, training guidance, or refinements to the system.

The BVSC recommends certification of *EVS Release 4.5.0.0, Version 4* voting system, and provisional approval of the ExpressVote ballot marking device component, as follows:

1) Certification for *EVS Release 4.5.0.0, Version 4* voting system, except for the ExpressVote component, provided the vendor makes beforehand necessary changes to its written

documentation[1] to reflect BVSC recommendations for greater specificity, clarity, and guidance regarding use of the system.

2) Provisional approval of the ExpressVote ballot marking device for use in any election conducted through May 1, 2017, with the ExpressVote ballot marking device to be used solely by persons with disabilities. The approval should be subject to the following conditions:
    a. The vendor should make the necessary changes to its written documentation[2] to reflect BVSC recommendations for greater specificity, clarity, and guidance regarding use of the system.
    b. The use of the ExpressVote ballot marking device, if approved, is also subject, before use in any election, to future revisions to Rule 1S-2.032, F.A.C., to provide standards for the accessible audio-visual onscreen display of the ballot and the printed vote summary card in accordance with section 101.5608(3), Florida Statutes.
    c. BVSC does not recommend an extension of this provisional approval, if granted, or recommend the approval of any future release of this ExpressVote ballot marking device unless the issues in the Continuous Improvements/Recommendations section of this report are addressed or are no longer an issue.

[1] ES&S has satisfactorily completed EVS Release 4.5.0.0. Version 4 manual updates/documentation requirements.

[2] ES&S has satisfactorily completed manual updates/documentation requirements as related to the ExpressVote ballot marking device.

Introduction

Elections Systems & Software, LLC (ES&S) submitted an application requesting Florida certification of the *EVS Release 4.5.0.0, Version 4* voting system. ES&S's request includes various optimization and performance enhancements as well as the introduction of the ExpressVote marking device. The ExpressVote is a voter interface device for voters with disabilities to be used at a polling location.

Background

ES&S's ElectionWare voting system first received certification in the state of Florida on February 9, 2012, for *EVS Release 5.0.0.0, Version 2*. On September 25, 2012, BVSC certified *EVS Release 4.0.3.0, Version 2*, which included enhancements to the precinct and high-speed scanners of the voting system.

In January 2014, ES&S's initial application for certification of *EVS Release 4.5.0.0, Version 2* was deemed to be complete. Through the subsequent review and testing process, the vendor made changes to the scope of the application and necessary modifications to the system. The application, now in its seventh iteration as *EVS Release 4.5.0.0, Version 4*,[3] includes optimization and performance enhancements throughout the voting system.

System Overview

This is a paper-based voting system with an element for compliance with HAVA provisions for precinct voting. The Florida certified voting system includes the Election Management System (EMS), a precinct scanner, a central count scanner, and precinct voter interface devices that can be used by a voter with a disability.

The EMS hardware platform is configured as either a stand-alone or a server/client configuration. The stand-alone configuration includes the election management system and the election results reporting manager; whereas, the server/client configuration includes one or more workstations (clients) which interconnect with a server. The system includes an option to upload election results wirelessly or using an analog ("landline") modem.

The EMS software configuration includes:

- ElectionWare – integrates the jurisdiction, districts, contests, and candidate database as the main pre-voting phase and post-voting phase that allows ballot images to be viewed. Provides the method to configure elections, create ballot design, add languages (including audio), export ballot/election definitions and view ballot images.
- Election Reporting Module (ERM) – a client application used for integrating election results acquisition, consolidation, and reporting. A second ERM client can be configured as a distribution system to display scrolling results on-screen and over the Intranet.
- The ballot-marking equipment includes the ExpressVote and AutoMARK voter assist terminal (VAT). The tabulating voting equipment includes the DS200 and the DS850.

[3] See Appendix B – Application Timeline Table

Figure 1. ExpressVote

The ExpressVote is a vote capture device with a verifiable paper record that is digitally scanned for tabulation. This system combines paper-based voting with touch screen technology, and integrates assistive peripherals such as headphones, tactile keypad, sip and puff device, or rocker/paddle control switch. The ExpressVote includes a mandatory vote summary screen that requires voters to confirm or revise selections prior to printing the summary of ballot selections using the internal thermal printer. Once printed, ES&S ballot scanners process the vote summary card. ES&S has fully integrated the ExpressVote with the existing suite of ES&S voting system products.

Figure 2. AutoMARK

The AutoMARK Voter Assist Terminal (VAT) is a voter interface device that allows a voter to mark a blank, preprinted paper ballot or assists a voter with contest selections via visual display, audio, or both. The voter uses the AutoMARK to navigate the ballot utilizing the touchscreen, physical keypad, and assistive support peripherals such as a sip and puff device or other assistive equipment. Also, the voter can use the AutoMARK to review a marked ballot and either to cast the ballot into an optical scan tabulator (like the DS200) or, if available, to cast the ballot into an attached ballot box, known as the AutoCast.

Figure 3. DS200

The DS200 is a voter interface device used to scan paper ballots. It is a precinct tabulator that can also be used to scan absentee ballots. This tabulator captures the voter's selections and digitally images the ballot. The DS200 uses a USB[4] drive for downloading the election definition, provides an option to capture cast ballot images on the USB, and provides the election results on the USB. The results data can then be manually uploaded into ERM, or the DS200 can transmit via secure wireless telecom network into ERM.

Figure 4. DS850

The DS850 optical tabulator is a high-speed scanner for use to scan absentee ballots or to conduct machine recounts of contests/races. The DS850 uses digital cameras to image paper ballots, capture voter selections on the image, and evaluate the results. It uses a USB drive for downloading the election definition, captures the cast ballot images on the USB, and provides the results on the USB. The results data are uploaded into ERM either via the USB or via an Ethernet connection. The DS850 also uses two COTS printers, one for printing reports and the other for recording and printing an audit log.

[4] The DS200, DS850, and ExpressVote use Delkin brand, ES&S qualified, USB flash drives.

Component Version List

The component version list describes in detail the components of the voting system under test.

Software

The software applications that comprise the voting system are listed below:

- Event Log Service (ELS) version 1.5.4.0
- Removable Media Service (RMS) version 1.4.4.0
- ElectionWare (EW) version 4.5.0.0
- AutoMARK VAT Previewer version 1.8.5.0
- ExpressVote Previewer version 1.2.3.0
- Election Reporting Manager (ERM) version 8.10.0.0
- Optional: Regional Results version 1.1.0.0
- Optional: ExpressPass version 1.0.0.0

System Software

The system's software requirements are in the table below.

Table 1. Election Management System software requirements

Product	Software/Firmware Version	Manufacturer	Description
EMS Workstation or Standalone Configuration - Required for all EMS components			
Windows Operating System	Windows 7 Professional-SP1	Microsoft	Operating System
Microsoft Offline Updates	8.6	WSUS	Offline operating system updates for security, etc.
Symantec Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Adobe Acrobat Standard	XI (11.0)	Adobe	Ballot PDF generation
RMCOBOL	12.06	Liant	COBOL Runtime
Removable Media Service (RMS)	1.4.4.0	ES&S	Supports graceful installation and removal of media
ES&S Event Log Service (UELS)	1.5.4.0	ES&S	Provides custom event log reports from the Windows Event Log
VAT Previewer	1.8.5.0	ES&S	View on-screen display of the AutoMARK in EMS
ExpressVote Previewer	1.2.3.0	ES&S	View on-screen display of the ExpressVote in EMS

Product	Software/Firmware Version	Manufacturer	Description
Election Reporting Manager (ERM)	8.10.0.0	ES&S	Election results reporting manager
ElectionWare – Client	4.5.0.0 (Client)	ES&S	Election database, ballot and election equipment configuration
ElectionWare – All Components	4.5.0.0 (Standalone)	ES&S	For Standalone only – installs the Postgres database and ElectionWare client
EMS Server - Required for EMS server			
Windows Operating System	Server 2008 R2 Standard Edition	Microsoft	Operating System
Microsoft Offline Updates	8.6	WSUS	Offline operating system updates for security, etc.
Symantec Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Cereberus FTP (Optional)	6.0.7.1	Cereberus	Secure, FTP server for DS850 file transfer
RMCOBOL	12.06	Liant	COBOL Runtime
Removable Media Service (RMS)	1.4.4.0	ES&S	Supports graceful installation and removal of media
ES&S Event Log Service (UELS)	1.5.4.0	ES&S	Provides custom event log reports from the Windows Event Log
ElectionWare – Server	4.5.0.0	ES&S	Installs the Postgres database
Network Results Server (Optional) - Results Server for Modeming Support			
Windows Operating System	Server 2008 R2 Standard Edition	Microsoft	Operating System
Microsoft Offline Updates Symantec	8.6	WSUS	Offline operating system updates for security, etc.
Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Cerberus FTP	6.0.7.1	Cerberus LLC	Secure, FTP server
Network Results Client (Optional) - Results Client for Modeming Support			
Windows Operating System	Windows 7 Professional-SP1	Microsoft	Operating System
Microsoft Offline Updates	8.6	WSUS	Offline operating system updates for security, etc.

Product	Software/Firmware Version	Manufacturer	Description
Symantec Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Adobe Acrobat Standard	XI (11.0)	Adobe	PDF reader for software help guides
IPSwitch WS_FTP	12.4.1	IPSwitch	Secure, FTP server
Election Reporting Manager (ERM)	8.10.0.0	ES&S	Processes tabulated results from DS200/DS850
Regional Results (Optional) - Regional Results Client for network environment			
Windows Operating System	Windows 7 Professional-SP1	Microsoft	Operating System
Microsoft Offline Updates	8.6	WSUS	Offline operating system updates for security, etc.
Symantec Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Adobe Reader XI	XI (11)	Adobe	PDF reader to access the help guide
ES&S Regional Results	1.1.0.0	ES&S	ES&S Software Application
Vendor Wireless Hot Spots	Jetpack 4G LTE	Verizon	Optional Wireless Hotspot for regional results transmission
	Netgear Zing	Sprint	
	4G LTE	AT&T	
Vendor Broadband Modems	USB551L	Verizon	Optional Broadband Modems for regional results transmission
	Netgear 341U	Sprint	
	Netgear 340U	AT&T	
ExpressPass (Optional) - ExpressPass Workstation			
Windows Operating System	Windows 7 Professional-SP1	Microsoft	Operating System
Microsoft Offline Updates	8.6	WSUS	Offline operating system updates for security, etc.
Symantec Endpoint Protection	Small Business Edition (2013)	Symantec	Anti-Virus
Adobe Reader XI	XI (11)	Adobe	PDF reader to access the help guide
ES&S ExpressPass	1.0.0.0	ES&S	ES&S Software Application
ExpressPass Printer	Model 402	Microcom	ExpressPass printer to print activation cards

Hardware

The hardware components of the voting system are listed and described below.

Election Management System Hardware

The Election Management System hardware requirements are in the table below.

Table 2. Election Management System hardware requirements

Product	Version	Manufacturer	Description
EMS Workstation - PC workstation for Network Configuration			
Processor	Dual Core	N/A	
RAM	2GB minimum, 4GB recommended	N/A	
Hard Disk	150GB	N/A	
Keyboard	Standard Keyboard	N/A	
Mouse	Standard Mouse	N/A	
Monitor	1048x768 minimum resolution	N/A	
CD/DVD reader	16x or faster	N/A	
USB Ports	Minimum of (2) USB 2.0 ports	N/A	
Ethernet Port	Available LAN connection	N/A	Suggested network switch to connect to EMS server
Report Printer	Standard Printer	N/A	
Gigabit Switch	DGS-1008G	D-Link	
EMS Server - Host system for Windows Server configurations			
Processor	Quad Core	N/A	
RAM	4GB minimum	N/A	
Hard Disk	320GB	N/A	
Keyboard	Standard Keyboard	N/A	
Mouse	Standard Mouse	N/A	
Monitor	1048x768 minimum resolution	N/A	
CD/DVD reader	16x or faster	N/A	
USB Ports	Minimum of (2) USB 2.0 ports	N/A	
Ethernet Port	Available LAN connection	N/A	
Report Printer	Standard Printer	N/A	
Network Results Server - Host system for network results server configuration			
Processor	Quad Core	N/A	
RAM	4GB minimum	N/A	
Hard Disk	320GB	N/A	
Keyboard	Standard Keyboard	N/A	

Product	Version	Manufacturer	Description
Mouse	Standard Mouse	N/A	
Monitor	1048x768 minimum resolution	N/A	
CD/DVD reader	16x or faster	N/A	
USB Ports	Minimum of (2) USB 2.0 ports	N/A	
Ethernet Port	Available LAN connection	N/A	
Report Printer	Standard Network Printer	N/A	
Rapidport/4	Digi Rapidport/4 USB to 4-port Modem	Digi	
Network Security Device	ASA 5505 Security Appliance	Cisco	

Precinct Count Systems

The precinct count scanner is the DS200.

Digital Scan 200 (DS200)

- DS200 Hardware Revision 1.2, 1.2.3.0, 1.3
  - DS200 Hardware v. 1.2.3.0 is equivalent to HW 1.2 plus ECOs[5] 1158, 1160, 1281, 1346, 1398, 1400 (Approved by BVSC on 7/31/13)
- Firmware version 2.11.0.3
  - Scanner Firmware v. 3.0.0.0
  - Power Management Firmware v. 1.2.10.0
- Auxiliary equipment for DS200
  - Plastic Ballot Box (HW Revision 1.2, 1.3, 1.4)
    - Plastic Ballot Bin HW v. 1.4 is equivalent to HW 1.3 plus ECOs 1251, 1266, 1351, 1388 (Approved by BVSC on 7/25/13 and 7/31/13)
  - Steel Ballot Box (With or without diverter)
  - Plastic DS200 Tote Bin
- USB Memory Device (Media) for DS200
  - Delkin USB (512MB, 1GB, 2GB, 4GB, 8GB)
- Compact Flash Memory Device (Internal) for DS200
  - Delkin Compact Flash (1GB)
- Optional Modem Configuration

[5] ECO = Engineering Change Order (process for initiating and controlling modifications to a system)

- Wireless Modem: AT&T, Sprint, Verizon
- Analog Modem: Multitech RJ-11

Precinct Voter Assistance Devices

The voting system has two voter assistance devices, the ExpressVote and the AutoMARK.

ExpressVote Voting System

- Hardware Revision 1.0
  - Input Output Board (IOB) v. 1.0.0.0
  - Scanner Printer Engine (SPE) v. 1.0.0.0
  - Detachable Key Board (DKB) v. 1.0.0.0
- Firmware version 1.2.3.0
- USB Memory Stick (Media) for ExpressVote
  - Delkin USB (512MB, 1GB, 2GB, 4GB, 8GB)
- Auxiliary equipment for the ExpressVote
  - Detachable key pad, rocker paddle, AVID headphones
  - ExpressVote Booth
  - ExpressVote Table with optional AutoCast box

AutoMARK Voter Assist Terminal (VAT)

- Model A200 AutoMARK Hardware Revision 1.1 and 1.3
  - Firmware version 1.8.5.0
  - Printer Engine Board (PEB) v. 1.70
  - Scanner Interface Board (SIB) v. 1.43
  - WinCE v. 5.00.20
  - Ultra v. 8.0.1
- Model A300 AutoMARK Hardware Revision 1.1 and 1.3
  - Firmware version 1.8.5.0
  - Printer Engine Board (PEB) v. 1.70
  - Scanner Interface Board (SIB) v. 1.43
  - WinCE v. 5.00.20
  - Ultra v. 8.0.1
- Auxiliary equipment for AutoMARK
  - AutoMARK Voter Assistance Table
  - Plastic AutoCast Ballot Box (HW Revision 1.0)

- Compact Flash Memory Card
    - SanDisk Compact Flash (512MB, 1GB, 2GB)
    - Toshiba Compact Flash (512MB, 1GB, 2GB)
- San Disk Image Mate or similar compact flash interface (for use with compact flash cards - AutoMARK)

Central / Absentee Count

The central count or absentee count scanners available are the DS200 and the DS850 and include one or more of the following:

Digital Scan 200 (DS200)

- DS200 Hardware Revision 1.2, 1.2.3.0, 1.3
    - DS200 Hardware v. 1.2.3.0 is equivalent to HW 1.2 plus ECOs 1158, 1160, 1281, 1346, 1398, 1400 (Approved by BVSC on 7/31/13)
- Firmware version 2.11.0.3
    - Scanner Firmware v. 3.0.0.0
    - Power Management Firmware v. 1.2.10.0
- Auxiliary equipment for DS200:
    - Plastic Ballot Box (HW Revision 1.2, 1.3, 1.4)
        - Plastic Ballot Bin HW v. 1.4 is equivalent to HW 1.3 plus ECOs 1251, 1266, 1351, 1388 (Approved by BVSC on 7/25/13 and 7/31/13)
    - Steel Ballot Box (With or without diverter)
    - Plastic DS200 Tote Bin
- USB Memory Device (Media) for DS200
    - Delkin USB (512MB, 1GB, 2GB, 4GB, 8GB)
- Compact Flash Memory Device (Internal) for DS200
    - Delkin Compact Flash (1GB)

Digital Scan 850 (DS850) Central Count Ballot Tabulator

- DS850 Hardware Revision 1.0
- Firmware version 2.8.2.2
- COTS Printers
    - OKI B430dn Laser Report Printer (Dedicated Report Printer)
    - OKI B431dn Laser Report Printer (Dedicated Report Printer)
    - OKI Microline 420 Dot Matrix Printer (Dedicated Audit Log Printer)
- Universal Power Supply: APC1500
- USB Memory Stick (Media) for DS850

- Delkin USB (512MB, 1GB, 2GB, 4GB, 8GB)

- Compact Flash Memory Card
  - Delkin Compact Flash (1GB)

In addition to the above components, ES&S is seeking approval for an upgrade to the optional Toolbox support utility:

- **Toolbox v. 2.0.0.0.** Toolbox v. 2.0.0.0 is a software upgrade to the previously approved Toolbox v. 1.0.0.0(zj) version. Toolbox is a software utility used in conjunction with ElectionWare software that jurisdictions may utilize to generate election audio files and test decks. Several performance enhancements were made to the approved 1.0.0.0(zj) version.

Voting System Hardware

The hardware components of the voting system are described in the table below.

Table 3. Voting system hardware components

Product	Version	Manufacturer	Description
DS200			
System Firmware	**2.11.0.3**	ES&S	Application Firmware for precinct based vote tabulation
Scanner Firmware	3.0.0.0	ES&S	Board level Firmware
Power Management Firmware	1.2.10.0	ES&S	Board level Firmware
System Hardware	1.2, 1.2.3.0, 1.3	ES&S	DS200 Voting System Hardware
Compact Flash Memory Card	N/A	Delkin	Supported sizes include 1 GB
USB Memory Stick	N/A	Delkin	Supported sizes include 512MB, 1GB, 2GB, 4GB, 8GB
Plastic Ballot Box	1.2, 1.3, 1.4	ES&S	Plastic Ballot receptacle
Metal Ballot Box	With or without Diverter	ES&S	Metal ballot receptacle
DS850			
System Firmware	**2.8.2.2**	ES&S	Application Firmware for central based vote tabulation
System Hardware	1.0	ES&S	DS850 Voting System Hardware
Compact Flash Memory Card	N/A	Delkin	Supported sizes include 1 GB
USB Memory Stick	N/A	Delkin	Supported sizes include 512MB, 1GB, 2GB, 4GB, 8GB
Report Printer	N/A	OKI	B430dn Laser Report Printer
		OKI	B431dn Laser Report Printer
Audit Printer	N/A	OKI	Microline 420 Dot Matrix Printer

ExpressVote Voting System			
System Firmware	**1.2.3.0**	ES&S	Application Firmware for ES&S' Voting System
Input Output Board (IOB)	1.0.0.0	ES&S	Board Level Firmware
Scanner Printer Engine Board (SPE)	1.0.0.0	ES&S	Board Level Firmware
Detachable Key Board (DKB)	1.0.0.0	ES&S	Board Level Firmware
System Hardware	1.0	ES&S	Hardware revision for ExpressVote
USB Memory Stick	N/A	Delkin	Supported sizes include 512MB, 1GB, 2GB, 4GB, 8GB
Headphones	N/A	AVID	Stock headphones[6]
ES&S AutoMARK			
System Firmware	**1.8.5.0**	ES&S	Application Firmware for HAVA compliant ballot marking system
Printer Engine Board (PEB)	1.70	ES&S	Board Level Firmware
Scanner Interface Board (SIB)	1.43	ES&S	Board Level Firmware
WinCE	5.00.20	Microsoft	Operating System
System Hardware	1.1/1.3	ES&S	Hardware revision for AutoMARK model A-200-00
	1.1/1.3	ES&S	Hardware revision for AutoMARK model A-300-00
Compact Flash Memory Card	N/A	SanDisk/Toshiba	Supported sizes include 512 KB, 1 GB, 2GB
Headphones	N/A	AVID	Stock headphones

Components under Review

The components under review include the following:

- Upgraded ElectionWare election management system
- Upgraded precinct count tabulator (DS200)
- Upgraded central count tabulator (DS850)
- Ballot marking devices used by voters with disabilities
    - Upgraded AutoMARK
    - ExpressVote, which is new to Florida
- Ancillary software

[6] The Technical Data Package (TDP) specifies the following headphones: AVID Airline Products, model number 1A6FV060CBK32ST (ExpressVote Operator's Guide, Firmware Version 1.2, Document Version 2.0, pg. 24). The vendor supplied the following: AVID educational headphones (unmarked).

- Toolbox
- ExpressPass (and ExpressPass thermal printer)

During the testing for certification, ES&S submitted numerous revisions to software and firmware to address issues discovered during testing. BVSC examined all revisions.

One revision submitted by the vendor enhanced the ExpressVote's capability of handling multiple vote summary cards for large multi-ballot card elections. The upgrade allows the voter's selections from all contests appearing on a ballot to be outputted on more than one vote summary card. (This is similar to a marksense ballot being comprised of several sheets.)

Tests for this certification process were conducted with some elections that fit onto one card, and some that fit onto multiple cards. For clarity, this report will identify tests as using "single-card" or "multi-card" elections, where relevant.

Conduct of Tests / Findings

The test objective was to verify that this new voting system meets the applicable requirements of the Florida Voting Systems Standards (FVSS), Florida Statutes and Administrative Rules, and the Help America Vote Act (HAVA) for usability and accessibility.

The FVSS qualification examination for this effort encompassed a physical and functional audit of the components under review. BVSC conducted additional tests to verify compliance with standards for sound pressure levels and observe ballot sensitivity. In addition, BVSC conducted mass ballot count tests on precinct and central count tabulators, as well as a mass marking test on the ExpressVote.

Systems Setup & Configuration

BVSC set up the ElectionWare voting system in two configurations: as a client-server configuration with modem and network capabilities, and as a stand-alone configuration.

Physical Audit

BVSC conducted a physical audit to verify that the voting system under test matched the specifications described in the application and the TDP documentation.

Findings:

BVSC found no discrepancies with the setup of the ElectionWare voting system configurations.

Functional System Audit

BVSC conducted a functional system audit to verify that all components of the voting system operate as described in the TDP.

Voting Equipment Menus – Administrative and Diagnostic Reports

BVSC performed a functional audit by testing all available menu options and administrative reports as well as systems functions in the course of testing.

Findings:

The system performed as indicated in the vendor's TDP and in accordance with FVSS, Florida Statutes, and Administrative Rules.

Mock Elections

BVSC conducted mock elections incorporating multiple-card ballots of varying ballot lengths (11-inch to 19-inch). BVSC used four election types: Presidential Preference Primary (PPP), municipal, primary, and general. The tests included both hand marked and machine marked ballots, as well as those cast via the accessible voting ballot marking machines (AutoMARK and ExpressVote), and used single-card and multi-card elections. All activities simulating an election were conducted using all equipment, from initial preparations and L&A (pre-election activities) through voting (election activities), election night and precinct level reporting (post-election and reporting activities). BVSC used ballot test decks and pre-determined results to compare to actual results.

Pre-Election Activities

Pre-election activities included coding or verifying the coding of the election database for each of the four elections (PPP, municipal, primary, and general), preparing the election media, preparing the ballot test decks, preparing and validating the expected results, and preparing the voting equipment. A universal primary contest (UPC) was included in the primary election definition.

Election Activities

Election activities included opening polls, casting ballots using test decks (including hand marked ballots and ballots marked using the AutoMARK and the ExpressVote), and closing polls.

Post-Election and Reporting Activities

BVSC examined test results against expected results. Post-election activities included generating reports.

This included uploading election results and verifying results in the ERM by election group (absentee, early voting, Election Day, and provisional voting). BVSC uploaded results directly, since modem testing was done in a separate test.

Partial and complete summary XML files and the 30-day precinct level XML files are produced by the XML File Utility, which is ancillary to the voting system. These are being examined in a testing activity separate from this certification effort.

Findings:

The voting system performed as indicated in the vendor's TDP and in accordance with FVSS, Florida Statutes, and Administrative Rules. BVSC did, however, encounter some ExpressVote issues that the vendor should address for future extension of the provisional approval for the ExpressVote precinct marking device, if granted, or in a future system release. Additional results of ExpressVote testing are discussed in another section of this report (see *ExpressVote*, pg. 30).

Precinct Tabulator Mass Ballot Counts

BVSC conducted mass ballot counts on the DS200 precinct scanner and on the DS850 central count scanner.

DS200

BVSC conducted a mass ballot count on one DS200 precinct scanner using the 2012 Miami-Dade County General Election definition. The minimum requirement was a ballot count of 9,900 ballots on a single scanner. The test deck contained 360 two-card ballots (720 cards total). Staff ran the test deck through the DS200 fifteen times, for a total of 10,800 ballots.

Specific details follow:

Table 4. Mass Ballot Count details for DS200

Election definition used:	2012 Miami-Dade County General Election
Ballot length:	17 inches
Number of scanner units used:	1
Number of test decks:	1
Number of runs per test deck:	15
Number of ballots per deck:	360
Number of cards per ballot:	2
Total number of ballots cast:	10,800
Total number of vote targets:	304,020

Findings:

The tested EVS 4.5.0.0, Version 4 DS200 (firmware 2.11.0.3) met the acceptance criteria for the precinct scanner mass ballot count. BVSC successfully scanned 10,800 ballots with 304,020 vote targets.

During testing of a previous system version, however, the DS200 presented an error in the poll closing process. After staff performed the DS200 'close polls' function, it presented a general system error, along with two user options, "Turn off voting machine," and "Ignore and continue." The user chose the latter as advised by the vendor, and the DS200 then presented the "This voting device is ready for poll to be opened" screen, with two options, "Don't open – Turn off," and "Open Poll." As advised by the vendor, the user chose "Open Poll." The DS200 presented the "Poll is open" screen, the public count was zeroed out, and a zero tape printed. The user was not given the option during this procedure to zero the public count, nor did a results tape print before results were reset.

The vendor resolved the issue by modifying the certification application with an upgrade to the DS200's firmware. BVSC found no anomalies during the 'close polls' process for Version 4 testing of the voting equipment.

Acceptance criteria is shown in the table below:

Table 5. Acceptance criteria for DS200

DS200 Mass Ballot Count – Acceptance Criteria	Expected	Accepted
Did the memory registers overflow?	No	✓
Did the public counters increment appropriately?	Yes	✓
Did the tabulated results agree with predetermined vote totals?	Yes	✓
Number of errors (must not exceed 1 in 1,000,000 vote targets). An error is defined as a target scan that produces a result other than the expected result.	≤ 1/1M vote targets	✓
Number of multiple feeds (must not exceed 1 in 5,000 ballots). A multiple feed occurs when the machine pulls multiple ballots and does not "catch" the error.	≤ 1/5K ballots	✓
Number of incorrect rejections of ballots (must not exceed 3%)	≤ 3% total ballots	✓

DS850

BVSC conducted a mass ballot count on two DS850 high-speed central count scanners using the 2012 Escambia County Primary Election definition. The minimum requirement was a ballot count of 192,000 ballots. The mass ballot count test deck contained 40 sets of a single-card, 320-ballot test deck. BVSC scanned the mass ballot count test deck 15 times to satisfy the 192,000 ballot count requirement.

Specific details follow:

Table 6. Mass Ballot Count details for DS850

Election definition used:	2012 Escambia County Primary
Ballot length:	17 inches
Number of scanner units used:	2
Number of test deck sets:	40
Number of runs per test deck:	15
Number of ballots per deck:	320
Number of cards per ballot:	1
Total number of ballots cast:	192,000
Total number of vote targets:	9,446,400

Findings:

The tested DS850s met the acceptance criteria for the central count scanner mass ballot count. BVSC successfully scanned 192,000 ballots with 9,446,400 vote targets.

Two jams occurred on the DS850s; however, neither was attributed to the scanners. One was due to a ballot with a folded corner; when staff duplicated the ballot, no jams occurred. The other jam occurred due to a scanner part that was improperly adjusted after scheduled cleaning; when the part was adjusted properly, no jams occurred.

To mitigate risk of scanner jams, ES&S recommends that users follow procedures outlined in the DS850 Standard Operating Procedures manual[7] to ensure proper cleaning and re-assembly of the scanners.

Acceptance criteria is shown in the table below:

Table 7. Acceptance criteria for DS850

DS850 Mass Ballot Count – Acceptance Criteria	Expected	Accepted
Did the memory registers overflow?	No	✓
Did the public counters increment appropriately?	Yes	✓
Did the tabulated results agree with predetermined vote totals?	Yes	✓
Number of errors (must not exceed 1 in 1,000,000 vote targets). An error is defined as a target scan that produces a result other than the expected result.	≤ 1/1M vote targets	✓
Number of multiple feeds (must not exceed 1 in 5,000 ballots). A multiple feed occurs when the machine pulls multiple ballots and does not "catch" the error.	≤ 1/5K ballots	✓
Number of incorrect rejections of ballots (must not exceed 3%)	≤ 3% total ballots	✓

Accessibility – Sound Pressure Level

The sound pressure level test is conducted to verify conformance to section 101.56062(1)(g-i), F.S., which describes the sound pressure level standards for a voting system's audio voting features. BVSC conducted a sound pressure level test on the AutoMARK because the firmware has been upgraded since the previously certified version. BVSC also conducted a sound pressure level test on the ExpressVote, which is new to Florida and thus requires demonstration of conformance to the statute referenced above. BVSC tested both machines using the AVID brand audio headsets supplied by the vendor.[8]

BVSC used an ITU-T P.50[9] test signal that was incorporated into an election definition. The test signal replaced the initial sound file normally heard by a voter at the beginning of an accessible voting session. The election definition played the test signal as a loop. BVSC took all sound pressure level measurements after the elapse of a complete loop, in order to capture instrument readings across the entire loop.

[7] DS850 Operator Guide, Document Version 1.0, Firmware Version 2.8 (Feb. 6, 2015), pg. 56.

[8] The vendor's application for certification lists "stock headphones" in the Component Version List. The TDP specifies the following headphones: AVID Airline Products, model number 1A6FV060CBK32ST (ExpressVote Operator's Guide, Firmware Version 1.2, Document Version 2.0, pg. 24). The vendor supplied the following: AVID educational headphones (unmarked).

[9] ITU-T P.50 - "ITU-T" is the telecommunication standardization sector of the "ITU," which is the International Telecommunication Union. ITU is a United Nations specialized agency for information and communication technologies. The "P.50" represents one of their "P Series" objective transmission standards/measures used for testing the transmission quality of artificial voices.

The test equipment included a Type I IEC 318[10] Brüel & Kjaer Artificial Ear, a Brüel & Kjaer Free-field ½-inch microphone (Type 4189), and Brüel & Kjaer model 2250-A analyzer[11], all of which were calibrated.

AutoMARK

The AutoMARK was tested with the headphones provided as part of the Technical Data Package (TDP).

Findings:

BVSC found that the AutoMARK complies with the applicable statute. The results of the sound pressure level tests for the AutoMARK are in the table below.

Table 8. Sound pressure level test results - AutoMARK

Sound Pressure Level Test Results – AutoMARK				
	Average Maximum Volume (dBA)[12]	**Average Minimum Volume (dBA)**	**Gain (dBA)[13]**	**Intermediate Level (dBA)[14]**
Right Headphone	111.20	61.20	50	76.20
Left Headphone	111.40	61.50	49.9	76.40

ExpressVote

The ExpressVote unit was tested with headphones provided as part of the TDP.

Findings:

BVSC found that the ExpressVote complies with the applicable statute. The results of the sound pressure level tests for the ExpressVote are in the table below.

Table 9. Sound pressure level test results - ExpressVote

Sound Pressure Level Test Results – AutoMARK				
	Average Maximum Volume (dBA)[15]	**Average Minimum Volume (dBA)**	**Gain (dBA)[16]**	**Intermediate Level (dBA)[17]**
Right Headphone	109.80	71.70	38.10	83.90
Left Headphone	109.20	71.20	38.00	83.30

Accessibility – Force

BVSC conducted the force test on the AutoMARK and the ExpressVote using multiple input methods for each: the available touchscreen, the rocker-paddle switch, and the audio tactile keypad (ExpressVote only). BVSC conducted these tests to determine compliance with section 101.56062(1)(l) F.S., which

[10] IEC - International Electrotechnical Commission. IEC 318 is a measure used for ear simulators as defined in ITU-T P-Series standards.

[11] Brüel & Kjaer 2250 Analyzer - A hand-held analyzer and sound level meter that performs high-precision measurement tasks in environmental, occupational and industrial application areas.

[12] Must be greater than 97 dB (decibels weighted).

[13] Maximum volume minus minimum volume. Must be greater than 20 dB.

[14] Must be between (Minimum volume + 12 dB) and 97 dB.

[15] Must be greater than 97 dB (decibels weighted).

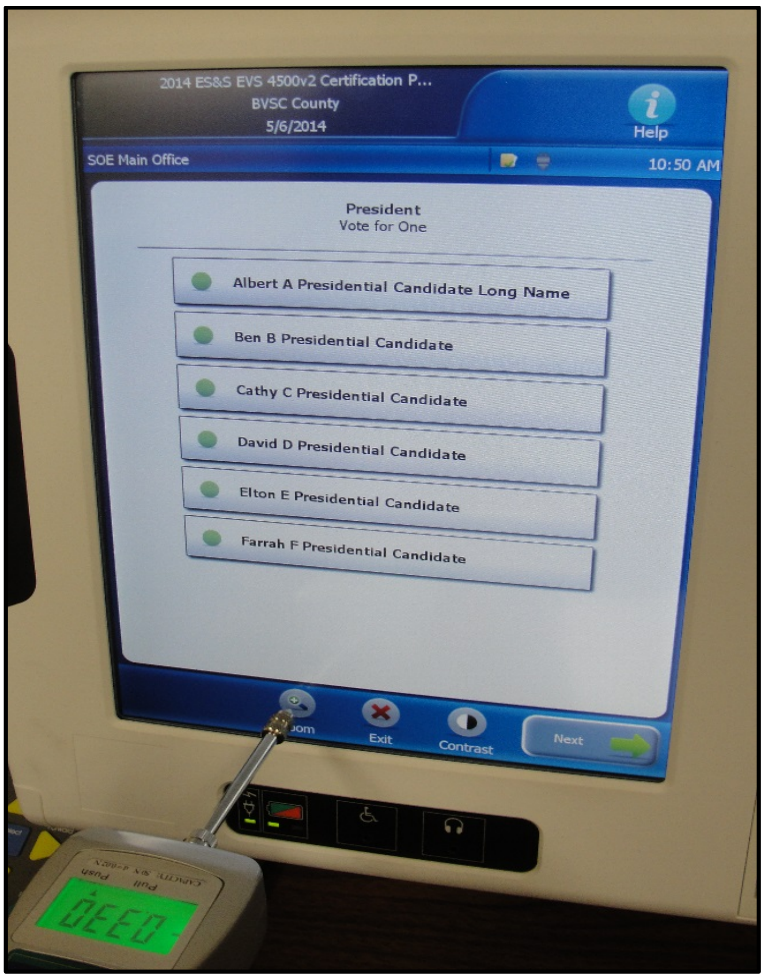
[16] Maximum volume minus minimum volume. Must be greater than 20 dB.

[17] Must be between (Minimum volume + 12 dB) and 97 dB.

requires that "the force required to operate or activate the controls must be no greater than 5 pounds of force."

BVSC conducted these tests during an accessible-voting session using a calibrated Dillon model GL digital force gauge (Figure 5). BVSC set the force gauge to 'zero' before each measurement, taking three measurements for each button or touchscreen position.

Figure 5. ExpressVote undergoes testing with a force gauge



AutoMARK

Findings:

No measurement exceeded the maximum of 5 pounds of force. BVSC found that the AutoMARK complied with section 101.56062(1)(l), F.S.

ExpressVote

Findings:

No measurement exceeded the maximum of 5 pounds of force. BVSC found that the ExpressVote complied with section 101.56062(1)(l), F.S.

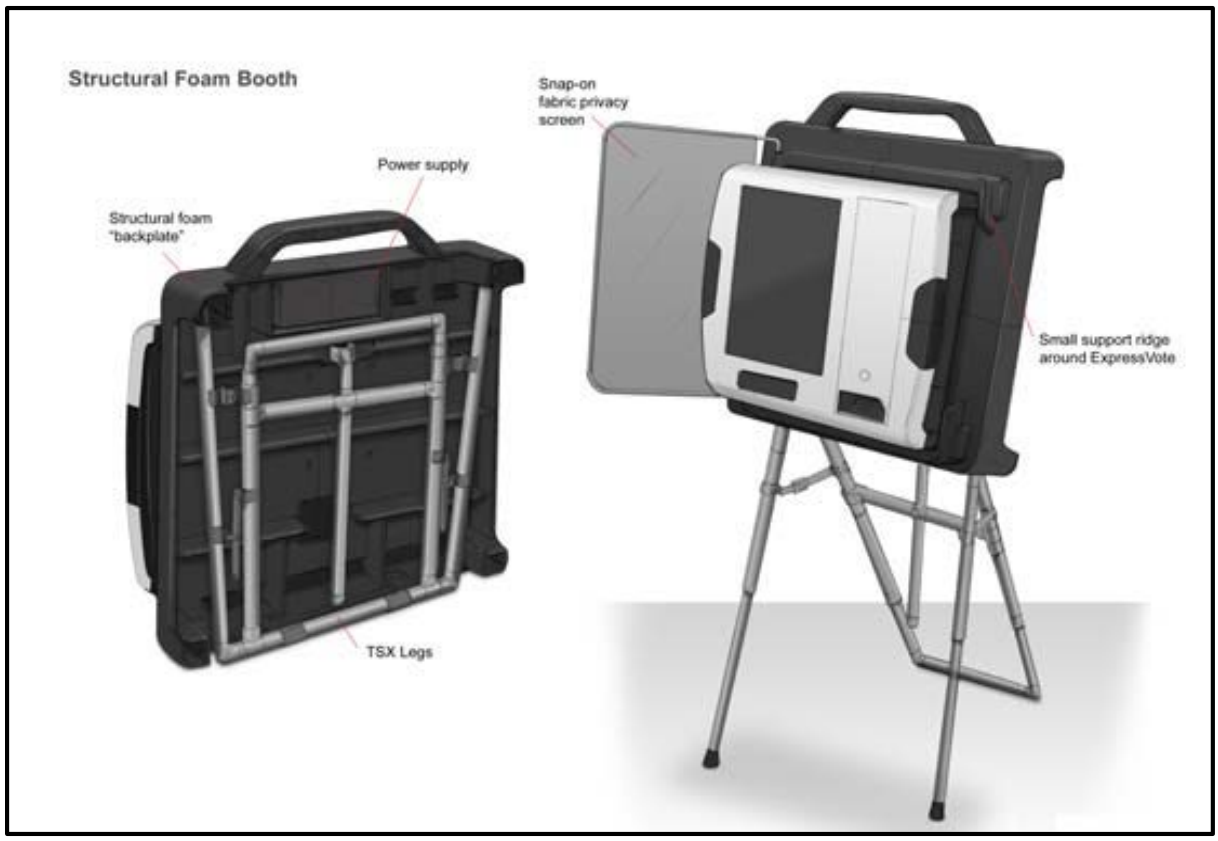
During initial testing, however, BVSC discovered a problem with the audio tactile keypad and an ExpressVote software bug. These findings are discussed in another section of this report (see *ExpressVote*, pg. 30).

Accessibility – Clearance Requirements

Voting booths or tabletop installations must meet minimum height and knee clearance dimensions, as well as privacy requirements, as set forth in section 101.56062(m), F.S. The vendor's application includes an ExpressVote voting booth and an ExpressVote table with optional AutoCast box.

The ExpressVote may be used in conjunction with the ExpressVote voting booth, which features a portable design, as shown below:

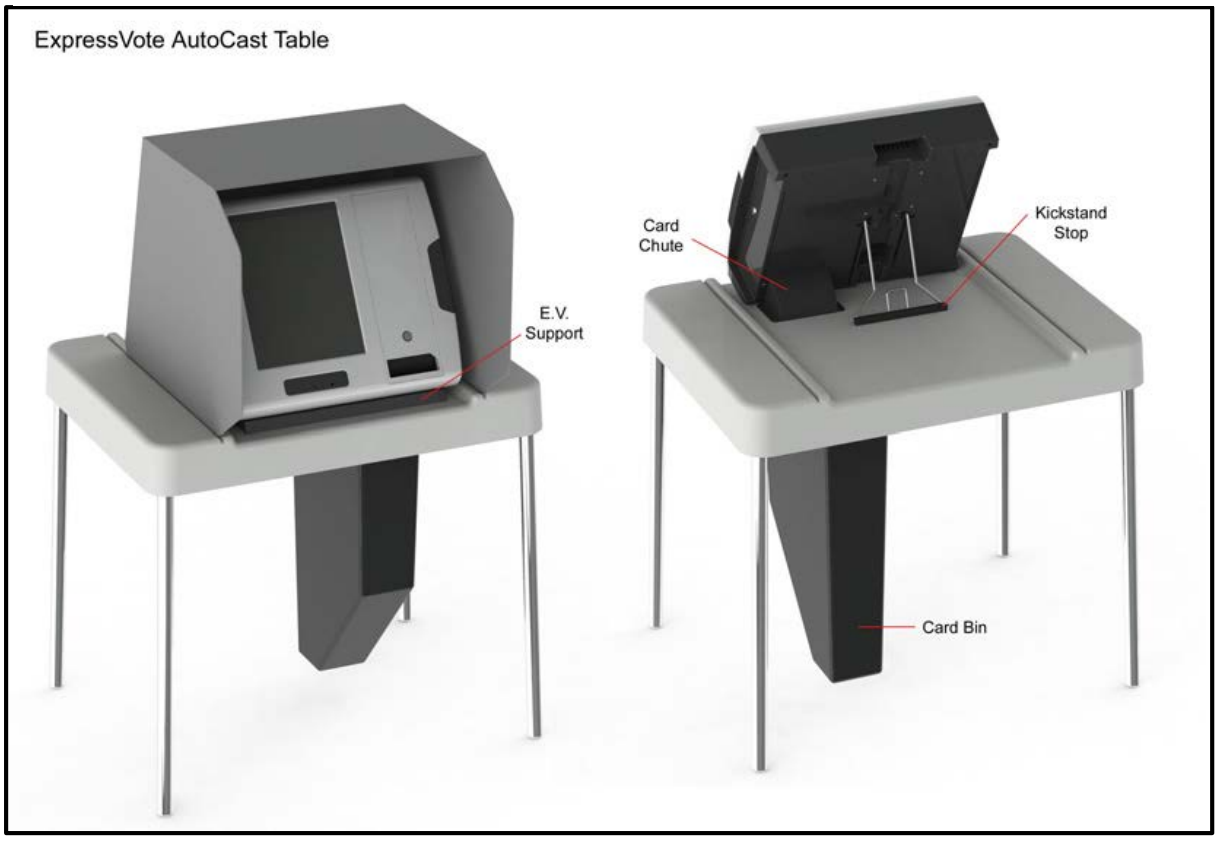
Figure 6. ExpressVote voting booth



The ExpressVote may also be placed on an optional ExpressVote table with AutoCast box, which allows the user to set up the ExpressVote to accept AutoCast ballots.[18] BVSC examined the AutoCast table (without the privacy hood) for compliance with applicable statutes. The AutoCast table is shown in the figure below:

[18] AutoCast is a feature whereby the voter, upon confirming and printing the vote summary card, may have the card automatically placed into the secure AutoCast box attached to the table for later tabulation by election officials instead of having the card returned to the voter for casting into a precinct scanner.

Figure 7. ExpressVote AutoCast Table, with and without privacy hood



The dimensions of the table[19] are as follows:

Table Area	Dimension
Top of table surface	33W" X 25D"X 31H"
Bottom of table surface	34W" X 26D" X 27H"
Leg span	37H" X 29D"

Findings:

BVSC measured the minimum height of the voting controls and the minimum knee clearance opening of the ExpressVote table with the AutoCast box. BVSC the found that the table complied with section 101.56062(m), F.S.

In lieu of testing for conformance to Florida Statutes, BVSC accepts the VSTL[20] test results on usability and accessibility for the ExpressVote voting booth.[21]

[19] ExpressVote Standard Operating Procedure, ver.1.0. Chap. 3.

[20] The VSTL is NTS (Huntsville, AL).

[21] Usability and Accessibility test performed in accordance with Volume I, Section 3 of the EAC 2005 VVSG. Report No. T71379.01-01 Rev. B (June 20, 2014).

Contest Recounts

BVSC conducted a recount to verify compliance with section 102.141(7), F.S., and the FVSS. BVSC selected one countywide race and one district-wide race in the municipal election. The recount was conducted using a DS200 precinct tabulator and a DS850 high speed tabulator. BVSC also conducted a recount in the primary election using the DS850. Both elections were "single card" elections. Non-recount races were suppressed in ElectionWare, per the TDP instructions. Results were verified against expected results.

Findings:

BVSC found that the voting system under test complied with applicable statutes and standards. ElectionWare allows the user to report results from only the affected races. Furthermore, a recount can be conducted on more than one race at a time, as demonstrated by processing both the countywide race and district-wide race in one recount.

Modems

BVSC examined the ability of the voting system to report and accumulate results from precinct scanners via modem communication. Staff conducted a mock PPP election with four DS200 precinct scanners, each using a different modem carrier or technology (landline, AT&T, Sprint, and Verizon).

Findings:

During the setup of the modem test, staff encountered difficulty getting the AT&T modem to connect to the SFTP server. The problem was eventually isolated to an Internet Access Point Name (APN number) in ElectionWare's DS200 transmission settings. The APN number that worked in the vendor's home location (Omaha, NE) did not work in the BVSC laboratory (Tallahassee). Once an APN number acceptable in this region of the country was entered in the ElectionWare settings, the AT&T modem capability worked.[22]

During subsequent testing of all modems, staff observed no anomalies and the system functioned as expected.

Regional Results Application

The voting system under test is capable of receiving and accumulating results transmitted via regional reporting sites.[23] The Regional Results software resides on a computer with a defined modem capability. In ElectionWare and the Regional Results Reporting software application, each polling location is assigned to a reporting region. The software application in the test was installed on a stand-alone laptop.

Staff conducted the PPP election using three reporting groups (Region 1, Region 2, and Region 3). Staff manually uploaded the results to the Regional Results Reporting software, and then transmitted the results via wireless modem (using an AT&T Hotspot) to the SFTP server.

[22] ElectionWare® Volume I: Administrator's Guide, Document Version 1.0, Software Version 4.5_v4 (February 7, 2015), pg. 92. Because the APN number will already be coded for the location of the end-user of the system, a Florida county will not have this issue. The APN number was not coded before arrival for testing in Tallahassee.

[23] Regional reporting sites are sites located in a county (or other election jurisdiction) that receive manually uploaded results from nearby polling places. They then electronically transmit those results to the SOE office. This method allows a county to send results to the SOE office quicker than complete manual uploading, and less expensively than the cost of deploying modems in every polling place.

Findings:

Staff noted that the regional results reporting software prevents precinct results from being uploaded twice. Staff did not observe any anomalies during the test.

Figure 8. Hotspots and Broadband Modems (AT&T, Verizon, Sprint)

Figure 9. Connecting the Regional Reporting Site to the AT&T Hotspot via Wi-Fi technology

Folded Ballot

Although Florida law and FVSS do not require this test, BVSC conducted a folded-ballot test to simulate absentee ballot processing. The objective was to observe the behavior of the precinct count and central count tabulators when folded ballots are scanned.

BVSC created a test deck for each of the four election types and four ballot lengths (11-inch PPP election; 14-inch municipal election; 17-inch primary election; and 19-inch general election). Different fold types were included in each test deck: Z-fold, C-fold, a fold through a vote target[24], a fold through a write-in, and the maximum number of folds allowed per ballot length[25].

BVSC cast ballots into the DS200 and the DS850, and compared the results.

Findings:

The DS200 did not accept two 11-inch ballots, one with a C-fold and one with the maximum number of folds (2). The scanner displayed a "ballot could not be read" message. This result is not considered an

[24] Folds through a vote target are outside the ballot printing specification as outlined in the ES&S Ballot Production Guide.

[25] The maximum number of folds per ballot length is determined by ES&S TDP ballot printing specifications. Lacking those, BVSC uses the following: 2 folds for 11"; 3 folds for 14" and 17"; and 4 folds for 19".

error, since the scanner gave the appropriate response. The DS200 correctly processed all the other ballots.

The DS850 accepted all ballots except for the same two ballots that were rejected by the DS200. The reason for rejection by both scanners could be attributed to ballot fatigue, a fold through a timing mark, or some other common issue. The DS850 also jammed on one 17-inch, write-in folded ballot. The ballot was duplicated and the DS850 processed the duplicate correctly. The DS850 processed all the other ballots correctly.

Scanner Sensitivity

BVSC subjected all tabulator devices (DS200 and DS850) to scanner sensitivity testing. Florida law and FVSS have no requirements for this test, so results are obtained for information purposes only. The purpose of the scanner sensitivity test is to observe the scanner's ability to read marks made by various types of marking instruments (pens, pencils, highlighters, etc.). The sensitivity test also demonstrates the scanner's ability to detect a marking when the vote target is not fully or properly marked (such as "✓", "○", etc.).

BVSC created the test decks by marking the first position on blank ballots with various marking instruments. The test deck included two ballots for each marking instrument: a baseline ballot with selected ovals fully marked (⬬), and a test ballot marked with a horizontal line 1 millimeter thick through the center of the target (⊖).

For testing the scanners' ability to detect a variety of improperly marked targets, BVSC marked the target using the vendor's approved pen (VL Ballot Pen - a BIC Grip Roller ball point pen (.7mm), Part# 6100). These results were compared to a baseline of the same targets, fully marked (⬬), using the same pen.

Findings:

BVSC observed that the precinct and central count scanners are able to detect a wide variety of marks made by several different marking instruments. However, the scanners consistently detected marks by marking instruments limited to softer grades of pencil (2B to 6B), a black felt tip pen, and the vendor's recommended pen (VL Ballot Pen). As such, the vendor clearly documents in its user manual and other documentation the recommended marking device(s).

System Clock

BVSC examined the DS200 precinct scanner and the ExpressVote for the ability to properly implement system time and date changes such as Daylight Saving Time and leap years.

Findings:

The DS200 properly performed an automatic reset for the spring ("spring forward") change to Daylight Saving Time. When the unit failed to automatically reset to the proper time ("fall back") for the return to standard time, the vendor was notified and responded with instructions for different testing conditions that accommodate the Linux code for time changes. When re-tested, the DS200 satisfactorily reset automatically to standard time.

Both the DS200 and the ExpressVote properly handled leap year and non-leap year date changes.

BVSC recommends the vendor update the documentation to clearly indicate how a user may test the DS200's ability to automatically reset to standard time (i.e., the "fall back" setting).

Battery Life

BVSC verified that the DS200 and the ExpressVote, when disconnected from the electrical outlet, functioned for the time period stated in the TDP documentation. The documentation states that the battery pack is capable of powering the system for at least two hours. [26]

BVSC staff turned the power on the unit and disconnected the AC adapter. The equipment was left running on battery power until the unit drained the battery and performed a shutdown operation. BVSC reconnected the AC adapter and reviewed the audit logs to determine the length of time the machine remained in a usable state, before complete drainage of the battery power occurred. As many as ten votes were cast (or marked, in the case of the ExpressVote) during the battery interval to demonstrate the unit's ability to operate on battery power. The table below reflects the outcome of these tests.

Table 10. Battery life test results

Battery Life Test Results		
	Battery Life per TDP	**Actual Battery Life**
DS200	At least 2 hours	2 hours 26 minutes
ExpressVote	At least 2 hours	4 hours 32 minutes

Findings:

The battery packs powered the DS200 and the ExpressVote for longer than the stated minimum battery life. It is expected that in a real-world scenario, in which the unit would be utilized during the battery interval, battery power would drain quicker relative to the number of ballots processed.

ExpressVote

The ExpressVote is a voting device not currently certified in Florida. The scope of the present application for approval is limited to use by any voter with a disability. The ExpressVote offers two options once a voter has made his/her selections and printed them on the human-readable vote summary card—either the voter may have the card returned to the voter who can then insert the card into a precinct or central count scanner for tabulation, or the voter can use an "AutoCast" function that allows the user to have the card automatically placed into the secure AutoCast box for later tabulation by election officials using a DS200 or DS850.

BVSC observed the ExpressVote in several test scenarios to examine the capabilities of this new device.

Mass Marking Examination (ExpressVote)

BVSC conducted a mass marking test to simulate a high number of ballots to be processed by the ExpressVote. BVSC used the 2012 Escambia County Primary Election (a "single card" election) to create a test deck by marking 257 activation cards using the ExpressVote. BVSC used blank cards as well as cards with activation codes pre-printed using the ExpressPass printer. BVSC cast the test deck in both a DS200 and a DS850, then compared the two tabulator results.

[26] Florida ES&S Voting System 4.5.0.0 v4 System Functionality Description, pg. 90.

Findings:

BVSC found no anomalies.

Multi-Card Ballot (ExpressVote)

Just as a paper ballot may consist of more than one sheet of paper, so the ExpressVote vote summary may summarize votes on more than one vote summary card. The vendor included this feature as a modification to the original application for certification, in order to enhance vote summary space. BVSC examined the voting system's capability of handling an ExpressVote multi-card ballot summary.

Findings

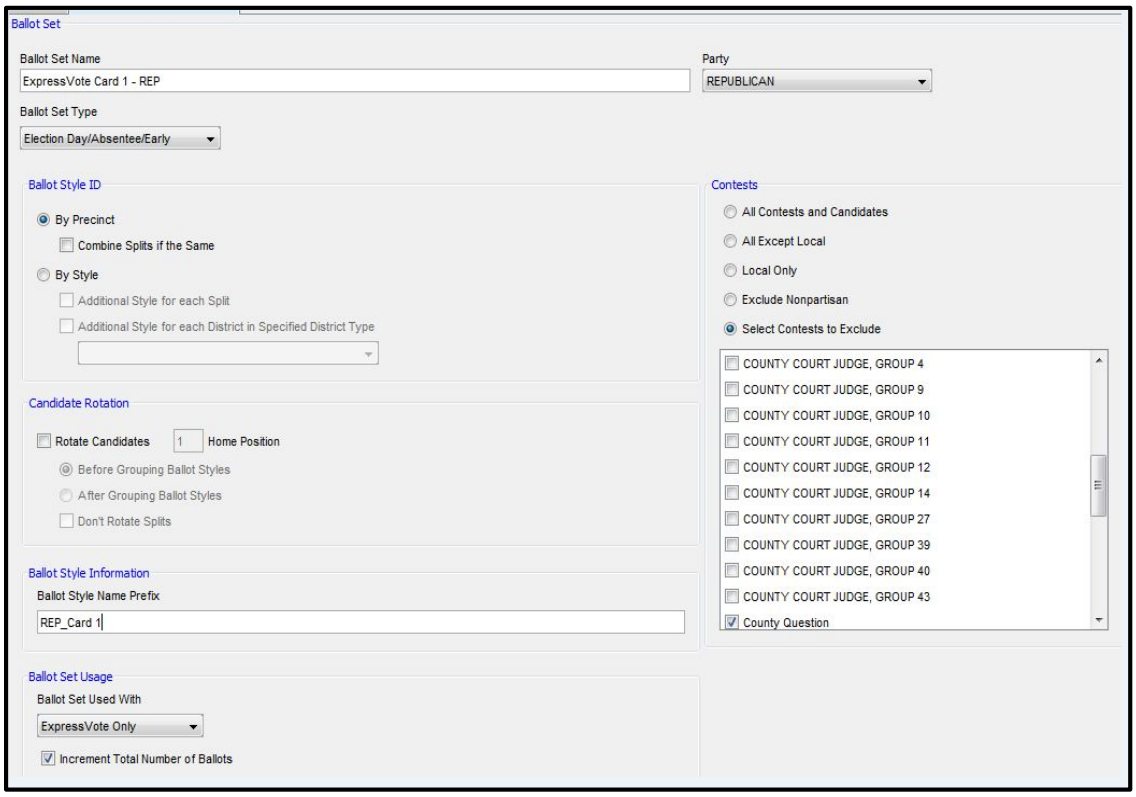
1. **Possibility of voting the same contests more than once when using blank ExpressVote card**. With the ExpressVote, the insertion of each blank card initiates a new voting session. In a multiple card election, a risk exists that a voter can vote the same contests more than once. For example:

   > *A voter is given two blank cards, to use as Vote Summary Card 1 and Vote Summary Card 2, which represent the complete ballot. After the appropriate precinct is selected on the ExpressVote, the ExpressVote displays the two ballot styles that are valid for that precinct. Voter selects "Vote Summary Card 1" as his first set of contests to vote, and proceeds to make vote selections and verify them. Voter then AutoCasts his vote summary card. Now voter is ready to make selections for the remaining contests on Vote Summary Card 2; however, there is nothing to indicate to the voter or to prevent the voter from inserting his remaining blank card and selecting 'Vote Summary Card 1' ballot style again.*

   ES&S recommends that only the ExpressPass printer be used for multi-card elections. With a pre-printed header bar code on each vote summary card, the voter can only vote the ballot style identified by the header bar code. The ExpressPass header bar code also contains the voter's precinct, which eliminates confusion and mistyping at the beginning of the ExpressVote voting session. The vendor must enhance the ExpressVote blank card, multi-card, voting functionality to prevent inadvertent voting of the same card more than once by the same voter. As a future enhancement, the option to disable the AutoCast feature, which is currently a setting at the unit level (on each ExpressVote), must be optionally overridden by a universal disable setting at the election definition level (in ElectionWare).

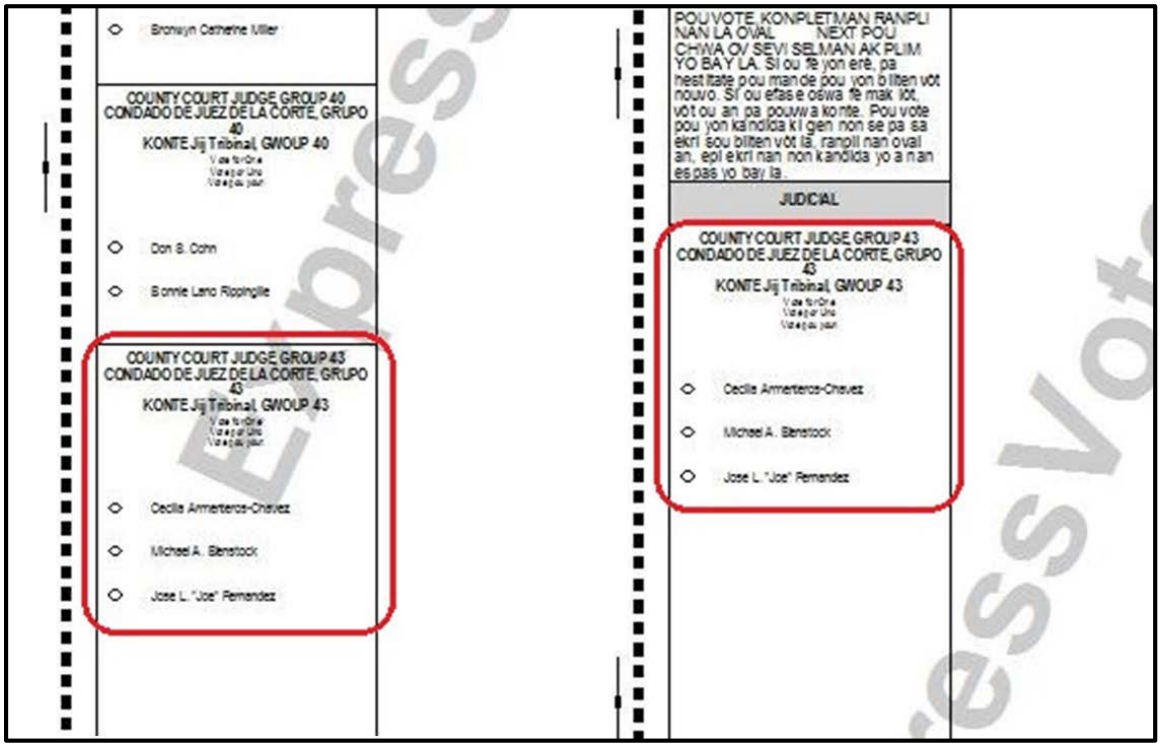
2. **Contest selection on multiple ExpressVote cards**. Coding the ExpressVote for a multi-card election poses a serious risk that a contest may be included more than once, or not at all. The contest selection process is a manual one in ElectionWare (Figure 10). It is possible for the user to include a contest on more than one card, or mistakenly exclude it from all cards. Furthermore, BVSC demonstrated that a voter could then vote the erroneous cards and, therefore, vote a contest more than once.

Figure 10. Contest selection for ExpressVote ballot styles



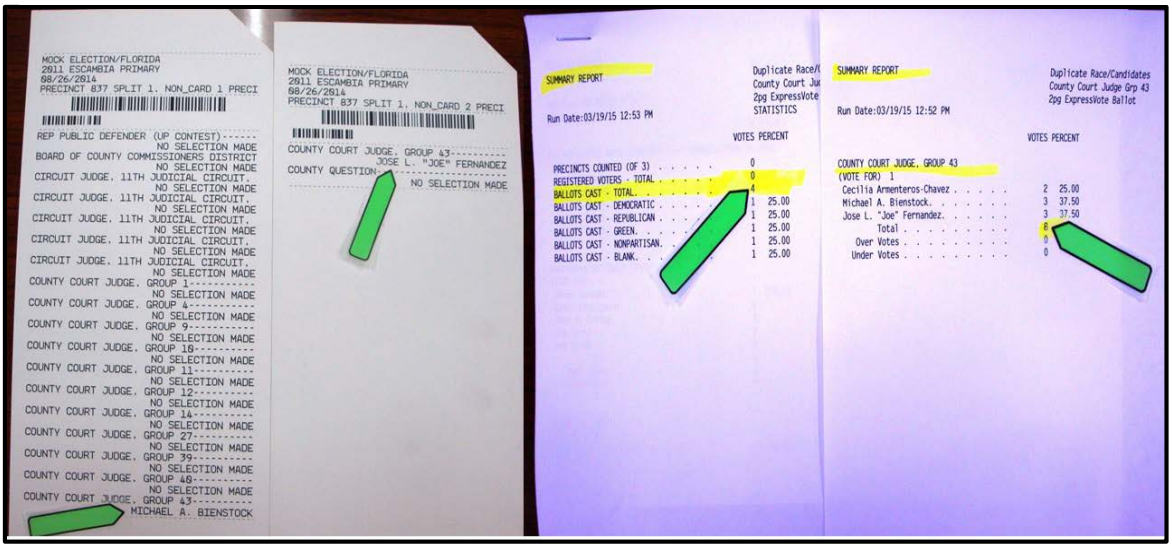
ElectionWare's ballot style preview shows the contest on both Card 1 and Card 2 (Figure 11). It is important to note that the paper ballots do not have this problem because the contest selection is generated automatically for paper ballots.

Figure 11. Contest on ExpressVote Card 1 and Card 2; figure shows ElectionWare ballot style view.


Bronwyn Catherine Miller
COUNTY COURT JUDGE GROUP 40
CONDADO DE JUEZ DE LA CORTE, GRUPO 40
KONTE Jij Tribinal, GWOUP 40
Don S. Cohn
Bonnie Lano Rippingille
COUNTY COURT JUDGE GROUP 43
CONDADO DE JUEZ DE LA CORTE, GRUPO 43
KONTE Jij Tribinal, GWOUP 43
Cecilia Armenteros-Chavez
Michael A. Bienstock
Jose L. "Joe" Fernandez
POU VOTE, KONPLETMAN RANPLI NAN LA OWAL NEXT POU CHWA OV SEVI SELIMAN AK PLIM YO BAY LA. Si ou fe yon ere, pa hesitate pou mande pou yon bilten vot nouvo. Si ou efase e oswa fe mak lot, vot ou an pa pouvwa konte. Pou vote pou yon kandida ki gen non se pa sa ekri sou bilten vot la, ranpli nan oval an, epi ekri nan non kandida yo a nan espas yo bay la.
JUDICIAL
COUNTY COURT JUDGE GROUP 43
CONDADO DE JUEZ DE LA CORTE, GRUPO 43
KONTE Jij Tribinal, GWOUP 43
Cecilia Armenteros-Chavez
Michael A. Bienstock
Jose L. "Joe" Fernandez

BVSC demonstrated that the double-contest problem perpetuates through the voting and tallying processes, thus resulting in extra votes for the contest (Figure 12).

Figure 12. Double-contest on ExpressVote ballot; and counted in election results



ES&S documentation should be updated to advise users to implement explicit procedural controls when selecting contests and verifying ballot styles, particularly when using the system in a multi-ballot card election. The vendor should remedy this risk for future extension of the provisional approval for the ExpressVote, if granted, or in a future system release.

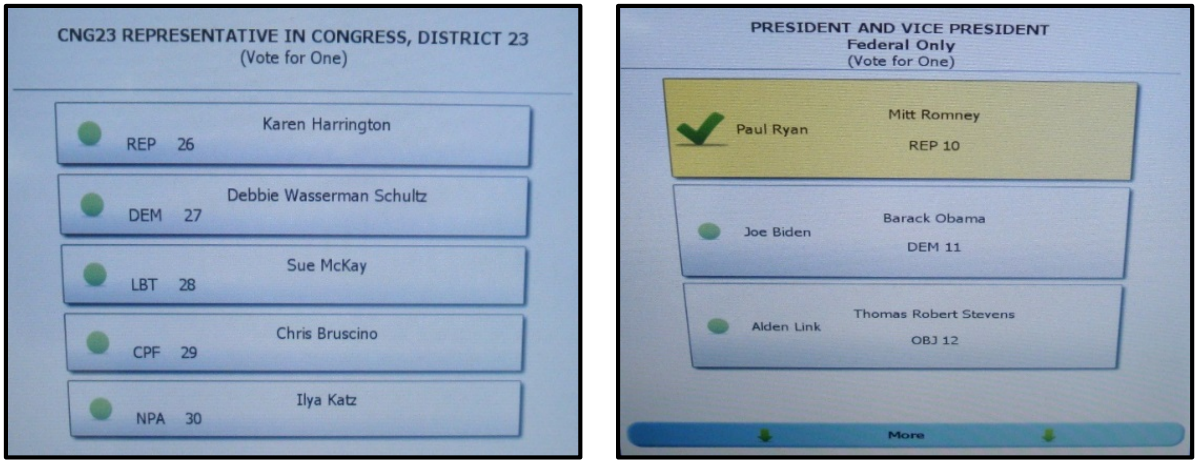
Vote Summary Card Capacity (ExpressVote)

The ExpressVote vote summary card was examined in terms of its capacity. It is important to note that, although ElectionWare allows a user to set the font size for the ExpressVote vote summary card to smaller sizes, **only** the "large" font size setting (corresponding to a 10-point font or greater) is allowed in the state of Florida. [27] Furthermore, contest names on a ballot display or card cannot be abbreviated or truncated.

Findings

The ExpressVote onscreen displays like a paper ballot. That is, the display shows the contest titles and all the candidate field names in their entirety (Figure 13).

Figure 13. ExpressVote onscreen display - full contest/candidate name

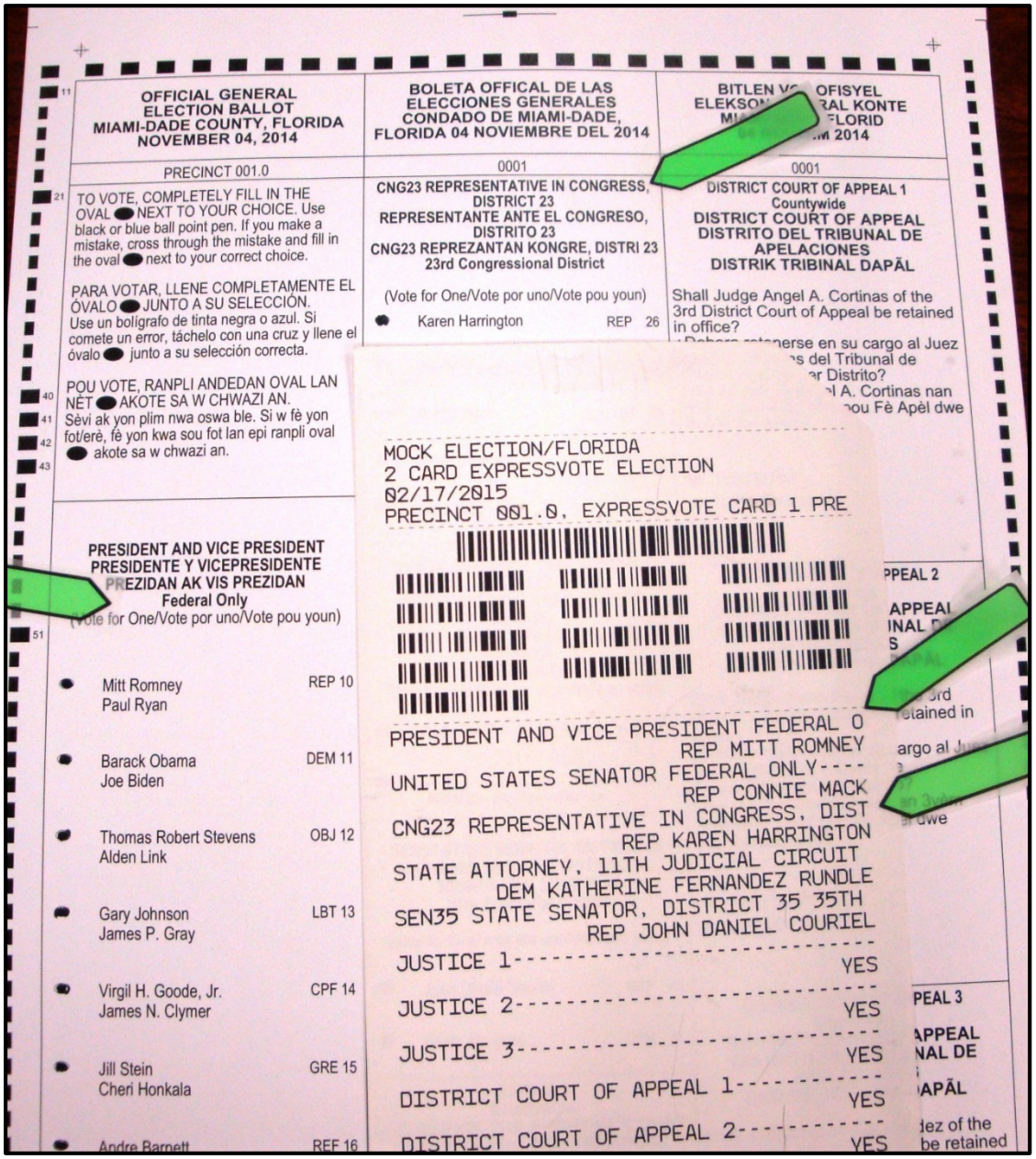


However, the fields referenced for printing on the ExpressVote summary card are not the same as those displayed on a paper ballot, the accessible ballot preview, or the accessible ballot onscreen displays. The vote summary card displays a maximum of **38** characters per line for contest titles and candidate names when the font size is set to "large." Titles and names exceeding the character limit do not wrap to the next line, so they are truncated to fit within these limits (Figure 14). While a paper ballot and onscreen displays use the "main" contest title or candidate name fields, the ExpressVote summary card utilizes the alternate short name fields for contest and candidate. Depending on the number of contests and names, the ExpressVote may end up truncating these fields on the summary card.[28]

[27] Counties may apply for an exception to the rule, just as they may do so for paper ballots, based on certified facts and circumstances justifying the deviation from rule requirements.

[28] This is a matter to be addressed in Rule 1S-2.032, Florida Administrative Code, which will need to provide standards for this hybrid system.

Figure 14. Contest titles and candidates, paper ballot vs. ExpressVote summary card

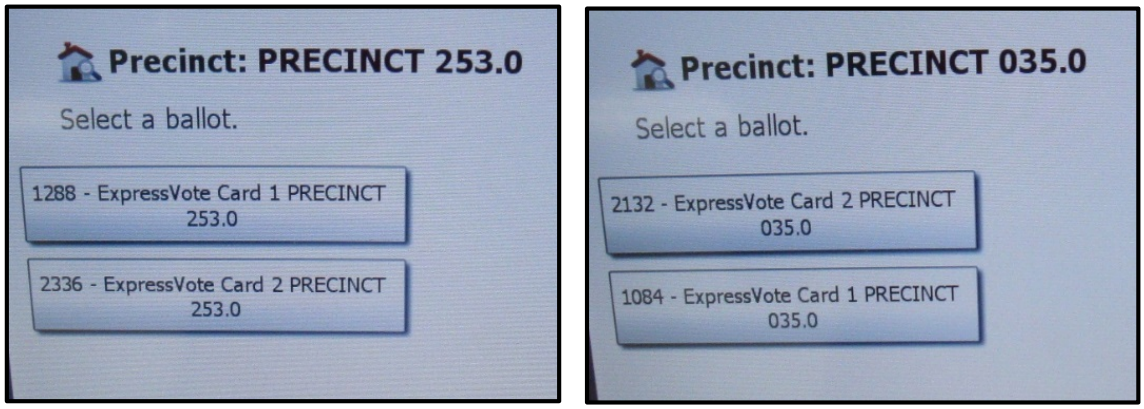

OFFICIAL GENERAL ELECTION BALLOT
MIAMI-DADE COUNTY, FLORIDA
NOVEMBER 04, 2014
BOLETA OFFICAL DE LAS ELECCIONES GENERALES
CONDADO DE MIAMI-DADE, FLORIDA 04 NOVIEMBRE DEL 2014
PRECINCT 001.0
0001
0001
TO VOTE, COMPLETELY FILL IN THE OVAL NEXT TO YOUR CHOICE. Use black or blue ball point pen. If you make a mistake, cross through the mistake and fill in the oval next to your correct choice.
PARA VOTAR, LLENE COMPLETAMENTE EL ÓVALO JUNTO A SU SELECCIÓN. Use un bolígrafo de tinta negra o azul. Si comete un error, táchelo con una cruz y llene el óvalo junto a su selección correcta.
POU VOTE, RANPLI ANDEDAN OVAL LAN NÈT AKOTE SA W CHWAZI AN. Sèvi ak yon plim nwa oswa ble. Si w fè yon fot/erè, fè yon kwa sou fot lan epi ranpli oval akote sa w chwazi an.
CNG23 REPRESENTATIVE IN CONGRESS, DISTRICT 23
REPRESENTANTE ANTE EL CONGRESO, DISTRITO 23
CNG23 REPREZANTAN KONGRE, DISTRI 23
23rd Congressional District
(Vote for One/Vote por uno/Vote pou youn)
Karen Harrington REP 26
DISTRICT COURT OF APPEAL 1
Countywide
DISTRICT COURT OF APPEAL
DISTRITO DEL TRIBUNAL DE APELACIONES
DISTRIK TRIBINAL DAPÃL
Shall Judge Angel A. Cortinas of the 3rd District Court of Appeal be retained in office?
PRESIDENT AND VICE PRESIDENT
PRESIDENTE Y VICEPRESIDENTE
PREZIDAN AK VIS PREZIDAN
Federal Only
(Vote for One/Vote por uno/Vote pou youn)
Mitt Romney Paul Ryan REP 10
Barack Obama Joe Biden DEM 11
Thomas Robert Stevens Alden Link OBJ 12
Gary Johnson James P. Gray LBT 13
Virgil H. Goode, Jr. James N. Clymer CPF 14
Jill Stein Cheri Honkala GRE 15
Andre Barnett REF 16
MOCK ELECTION/FLORIDA
2 CARD EXPRESSVOTE ELECTION
02/17/2015
PRECINCT 001.0, EXPRESSVOTE CARD 1 PRE
PRESIDENT AND VICE PRESIDENT FEDERAL O
REP MITT ROMNEY
UNITED STATES SENATOR FEDERAL ONLY----
REP CONNIE MACK
CNG23 REPRESENTATIVE IN CONGRESS, DIST
REP KAREN HARRINGTON
STATE ATTORNEY, 11TH JUDICIAL CIRCUIT
DEM KATHERINE FERNANDEZ RUNDLE
SEN35 STATE SENATOR, DISTRICT 35 35TH
REP JOHN DANIEL COURIEL
JUSTICE 1---------- YES
JUSTICE 2---------- YES
JUSTICE 3---------- YES
DISTRICT COURT OF APPEAL 1---------- YES
DISTRICT COURT OF APPEAL 2---------- YES

General Information/Observations (ExpressVote)

Following are findings observed during various phases of the test process.

1. **Vote Summary Card list order display.** Prior to activating an ExpressVote voting session, the ExpressVote vote summary cards, equivalent to ballot styles, are listed. BVSC found that the sort order for this list is not consistent. Sometimes Card 2 is listed first, and sometimes Card 1 is at the top of the list (Figure 15). No feature exists to systemically 'force' a consistent card order. Consequently, this inconsistency increases the potential for selecting the wrong ballot style onscreen.

Figure 15. ExpressVote inconsistent card order


Precinct: PRECINCT 253.0
Select a ballot.
1288 - ExpressVote Card 1 PRECINCT 253.0
2336 - ExpressVote Card 2 PRECINCT 253.0
Precinct: PRECINCT 035.0
Select a ballot.
2132 - ExpressVote Card 2 PRECINCT 035.0
1084 - ExpressVote Card 1 PRECINCT 035.0

While this inconsistency should not preclude approval of the ExpressVote, additional procedural safeguards can mitigate the potential for human error. This system inconsistency, however, should be eliminated before permitting an extension to the provisional approval of the ExpressVote, if granted.

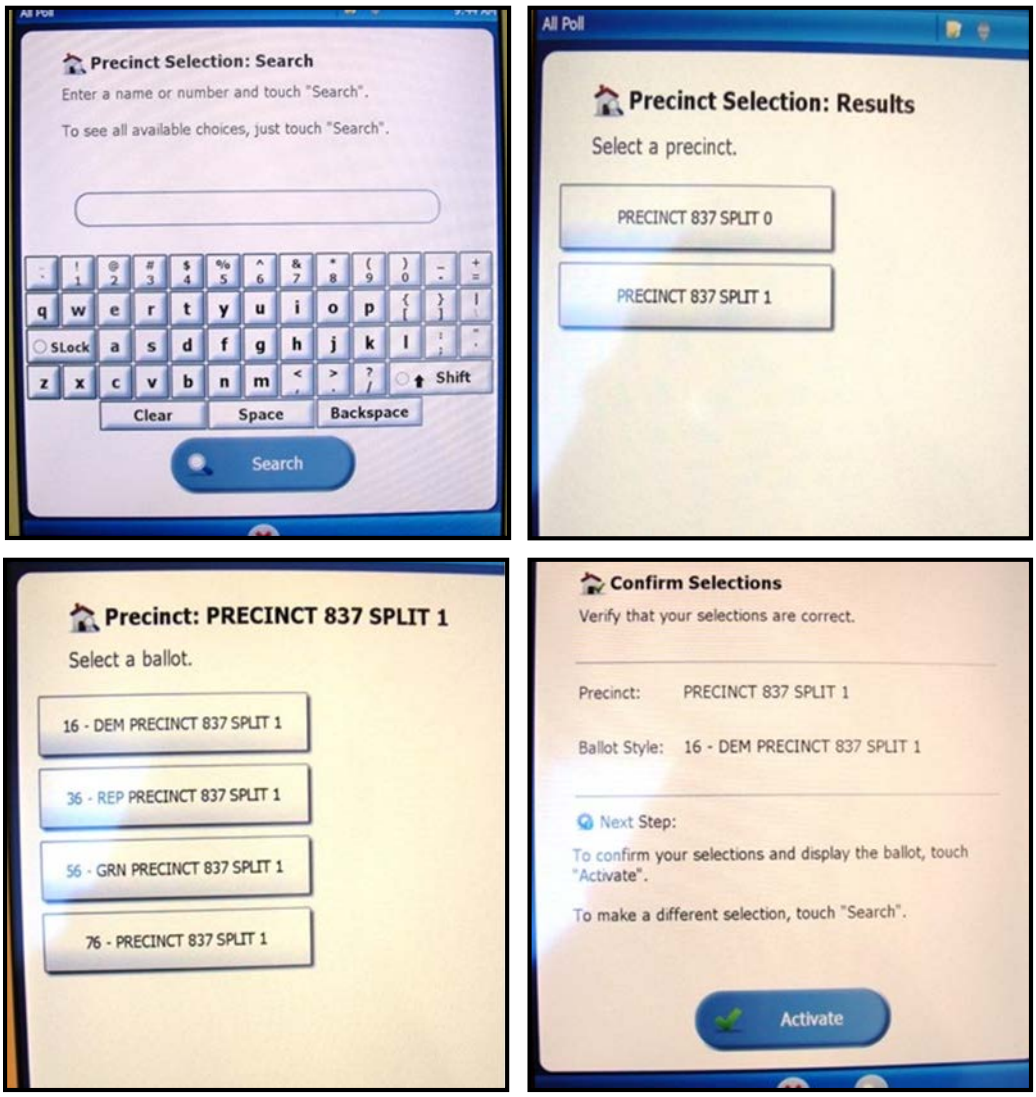
2. **Style Sheets process**. During initial testing of the two-card ballot in a primary election, the DS200 correctly tabulated the first card's votes. The votes on the second card, however, tabulated incorrectly as undervotes. The vendor responded with instructions for the user to change the style sheets for the ExpressVote ballot styles. Once the new instructions were followed, the second page of the ExpressVote tabulated correctly.

   BVSC recommends provisional approval conditioned upon the vendor modifying the user documentation to include the vendor's additional instructions regarding the user's use of the system's style sheets functionality.

3. **Manual selection of precinct-ballot style.** To begin an accessible voting session on an ExpressVote programmed for early voting, the election official must be present to manually select the precinct, split (if any), and ballot style, because there is no audio at that point in the session (Figure 16). There is a potential risk that the election official may type in the wrong selections. To avoid this problem, ES&S recommends that only the ExpressPass printer be used for multi-card elections as the summary card will be imprinted with a bar code specific to the precinct, split and ballot style.[29] Then, when the summary card is inserted into the ExpressVote, the precinct/split/ballot style are automatically selected and the voting session begins with the voter's language screen.

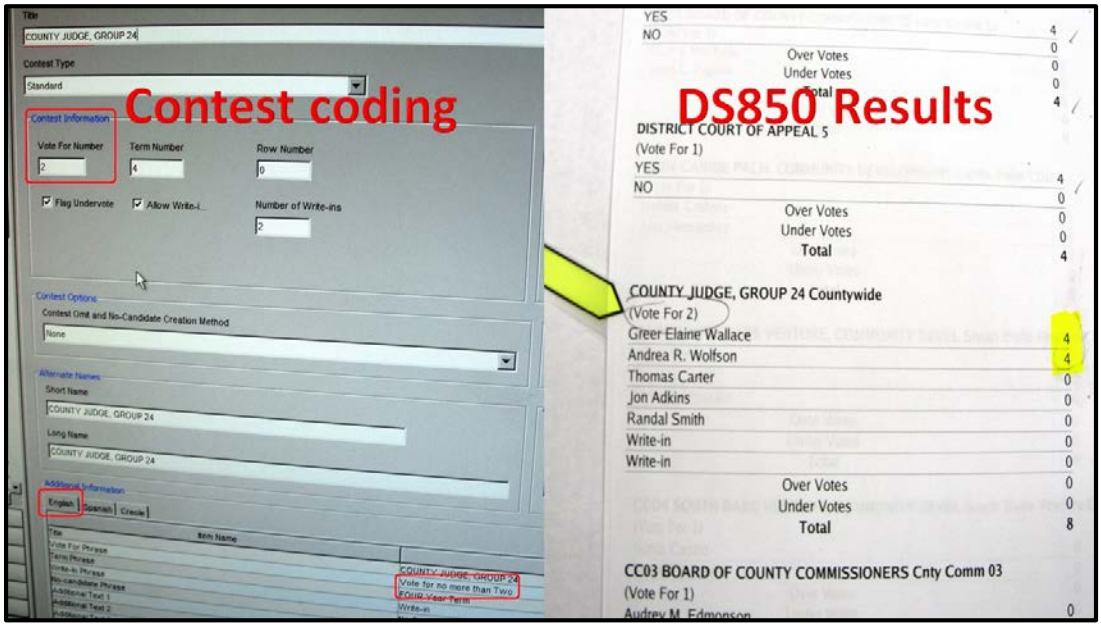
[29] ExpressVote Operator's Guide, Firmware Version 1.2, Document Version 1.1 (Feb. 25, 2015), pg. 31.

Figure 16. ExpressVote precinct, split, and ballot style selection screens, and confirmation screen (with blank vote summary card insertion)


Precinct Selection: Search
Enter a name or number and touch "Search".
To see all available choices, just touch "Search".
Clear
Space
Backspace
Search
All Poll
Precinct Selection: Results
Select a precinct.
PRECINCT 837 SPLIT 0
PRECINCT 837 SPLIT 1
Precinct: PRECINCT 837 SPLIT 1
Select a ballot.
16 - DEM PRECINCT 837 SPLIT 1
36 - REP PRECINCT 837 SPLIT 1
56 - GRN PRECINCT 837 SPLIT 1
76 - PRECINCT 837 SPLIT 1
Confirm Selections
Verify that your selections are correct.
Precinct: PRECINCT 837 SPLIT 1
Ballot Style: 16 - DEM PRECINCT 837 SPLIT 1
Next Step:
To confirm your selections and display the ballot, touch "Activate".
To make a different selection, touch "Search".
Activate

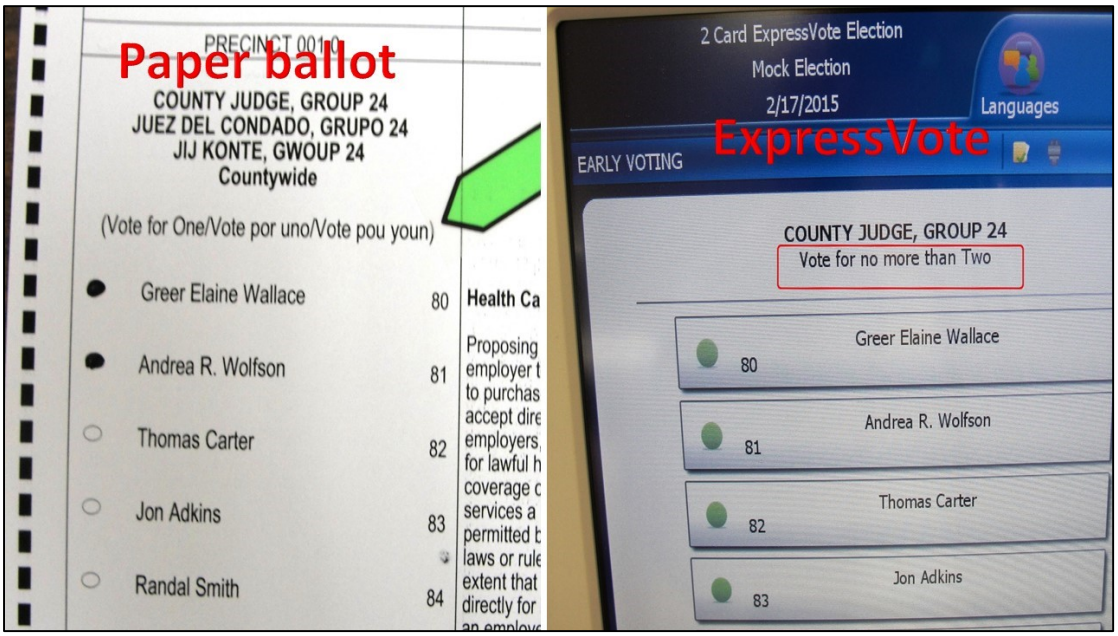
4. **The "Vote for x" contest instruction did not match the "vote for" setting across all voting system components.** During testing, BVSC found that there was a difference in the displayed "vote for" number among various voting system components. The general election definition was coded with a 'Vote for 2' setting in a particular contest, and the tabulators correctly tallied the contest as a 'Vote or 2' (Figure 17).

Figure 17. Contest coded for 'Vote for 2'; DS850 tabulated 'Vote for 2'



The voter instruction on the paper ballot, however, read “Vote for One,” whereas the voter instruction on the ExpressVote was displayed as “Vote for no more than Two” (Figure 18).

Figure 18. Paper ballot instruction 'Vote for One'; ExpressVote 'Vote for no more thanTwo'



The problem was traced to a voter instruction manually entered in the ballot style. Any extension of certification, if granted, should be conditioned upon the vendor programming the following feature in any future release: a user warning and/or confirmation process whenever manual (user created) text is used in lieu of data fields to generate the ballot styles. In the short-term, the certification should be conditioned on the vendor providing explicit procedures in its user manual and other documentation to help users of the system who

choose to manually enter voter instructions and other ballot style content in the style sheets to verify their choices.

During the EVS Release 4.5.0.0 ExpressVote marking device examinations, BVSC also identified the following issues that required vendor response:

- **"Print" button fatal error.** During a session in which the audio tactile keypad was engaged, BVSC found that pressing the "print" button on the screen caused the ExpressVote to present a fatal error.
  - The vendor was notified and responded with a modification to the application for certification due to a required firmware update for the ExpressVote. BVSC re-tested this function and found no further anomalies.
- **"Pause" button fatal error.** BVSC encountered a software bug in the ExpressVote that produced a fatal error when the "pause" button on the audio tactile keypad was pressed.
  - ES&S responded with a new version of the ExpressVote firmware. BVSC re-tested this function and found no further anomalies.
- **Vote target display separation.** During testing, BVSC discovered that the "yes" and "no" referenda vote targets could be separated on the display screen. The screen displayed the "yes" vote target at the bottom of one screen, and the user would be required to scroll to the next screen to view the "no" vote target. This is contrary to Uniform Primary and General Election Ballot Rule 1S-2.032(8).
  - ES&S responded with a new software version that fixed this display issue. BVSC re-tested this function and found no further anomalies.

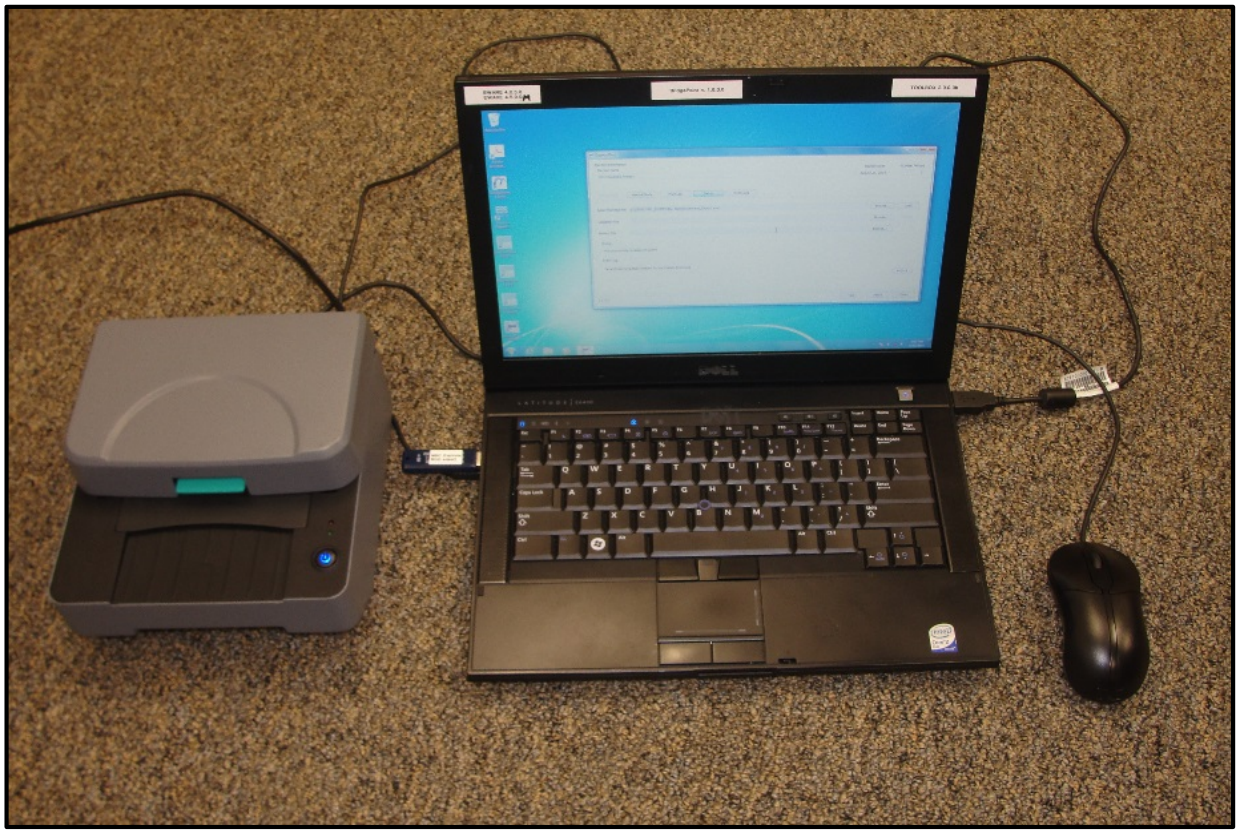
ExpressPass Printer / Bar Codes

ExpressPass is an optional on-demand application that is used to print activation cards[30] with bar codes containing precinct and ballot style identification for use with ExpressVote. The stand-alone application resides on a computer connected to an ExpressPass thermal printer.

The ExpressPass application functions in either stand-alone mode, or in a monitor mode where the application monitors requests from a voter registration system over a shared network folder. The application is used to import an election definition from ElectionWare, process requests for a given precinct, then determine the voter's ballot style and print a ballot activation code (bar code) on the activation card using the ExpressVote thermal card printer.

[30] An "activation card" is an ExpressVote blank vote summary card that has the activation bar code and verification information printed on it via the ExpressPass printer. With this information printed on the card, the card can then be used to 'activate' a voting session.

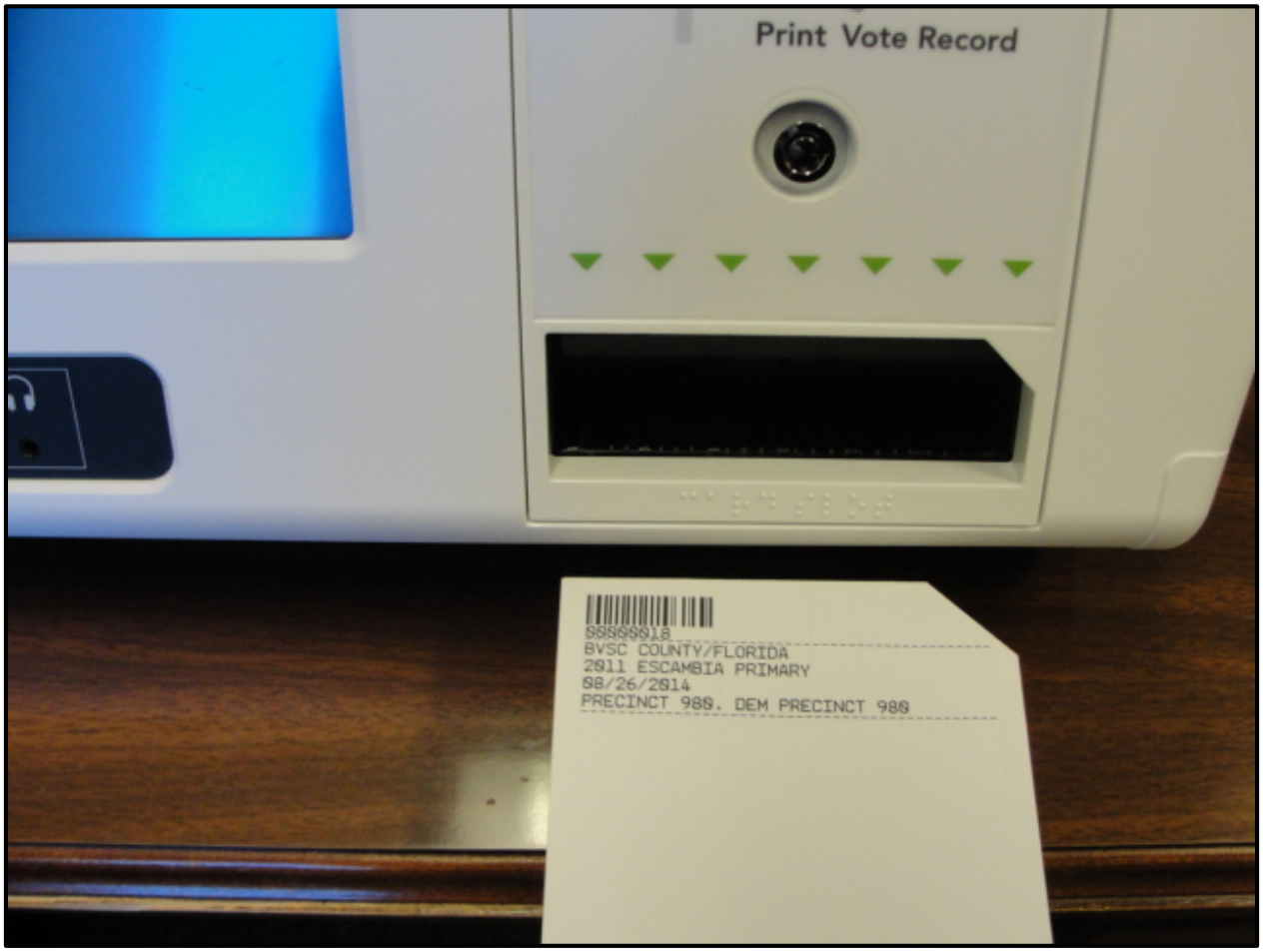
Figure 19. ExpressPass on a computer, with ExpressPass thermal printer



BVSC examined the ExpressPass functionality on a stand-alone computer by importing the ballot styles using both the primary and general elections.

BVSC also analyzed the ExpressPass bar codes on the activation cards. BVSC verified that the vote selections displayed on the ExpressVote's summary screen match the votes tabulated on the precinct and central count tabulators. BVSC also verified that the ExpressVote reads the vote summary card, independent of the ExpressVote unit used.

Figure 20. Voter activation card showing pre-printed header (to be inserted into ExpressVote)

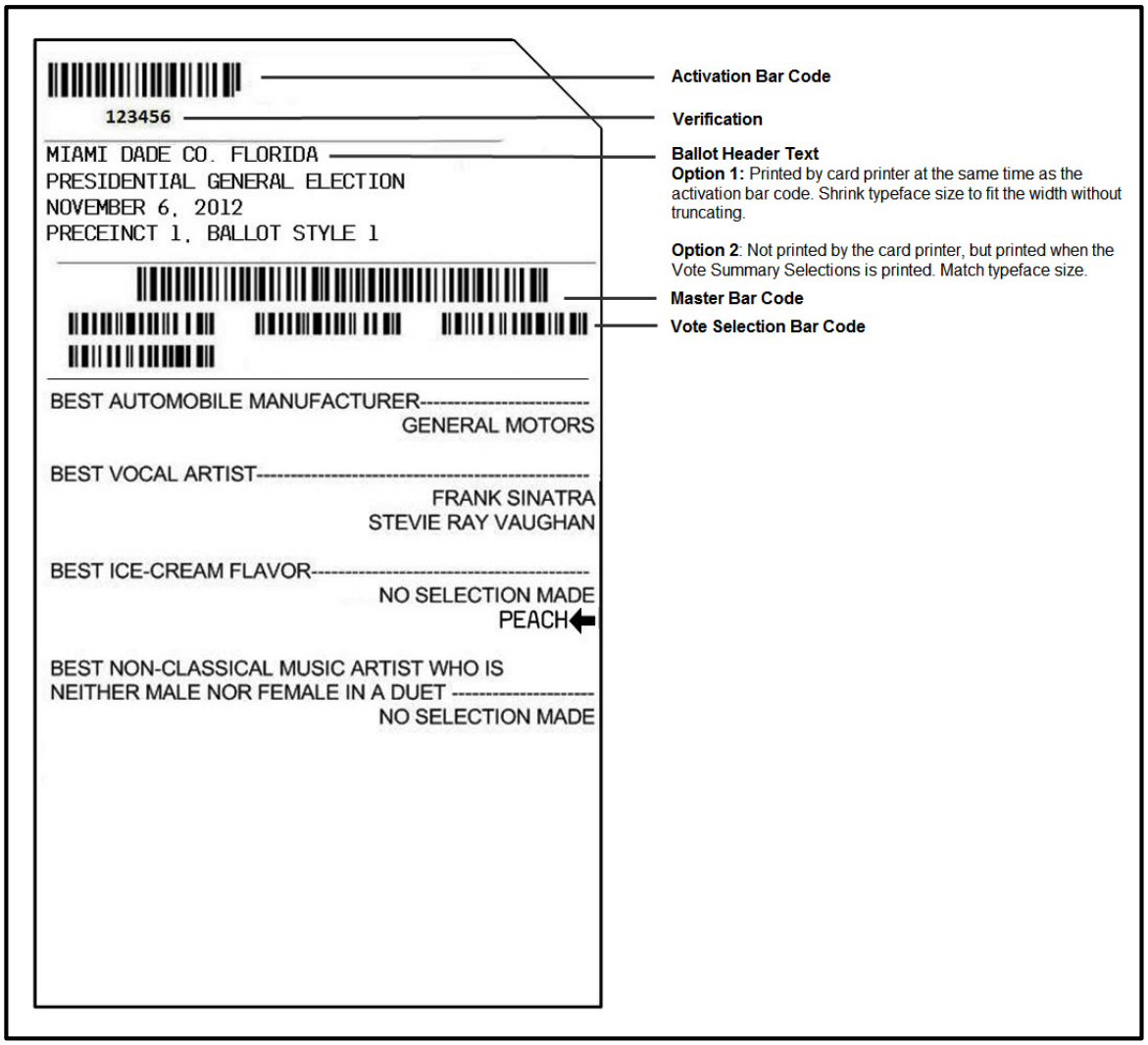


ExpressPass pre-prints header information onto a blank vote summary card (Figure 20). The pre-printed header includes the activation bar code, verification number, and ballot header text.

A voted vote summary card, with explanations of the various bar codes that are used,[31] is shown below (Figure 21). The ExpressPass pre-prints the activation bar code, the verification number (corresponding to precinct or ballot style), and the ballot header text. If the user opts not to use ExpressPass, the ExpressVote will print all as shown *except* the activation bar code and verification number, after the voter has made his/her selections and printed the vote summary card in the ExpressVote.

[31] ExpressVote Operator's Guide, Firmware Version 1.2, Document Version 2.0, pg. 30.

Figure 21. Marked vote summary card


123456
MIAMI DADE CO. FLORIDA
PRESIDENTIAL GENERAL ELECTION
NOVEMBER 6, 2012
PRECEINCT 1, BALLOT STYLE 1
BEST AUTOMOBILE MANUFACTURER----------
GENERAL MOTORS
BEST VOCAL ARTIST----------
FRANK SINATRA
STEVIE RAY VAUGHAN
BEST ICE-CREAM FLAVOR----------
NO SELECTION MADE
PEACH
BEST NON-CLASSICAL MUSIC ARTIST WHO IS
NEITHER MALE NOR FEMALE IN A DUET ----------
NO SELECTION MADE
Activation Bar Code
Verification
Ballot Header Text
Option 1: Printed by card printer at the same time as the activation bar code. Shrink typeface size to fit the width without truncating.
Option 2: Not printed by the card printer, but printed when the Vote Summary Selections is printed. Match typeface size.
Master Bar Code
Vote Selection Bar Code

Findings:

BVSC found that the ExpressPass only prints one vote summary card at a time.

The ExpressPass printer quickly “grabs” the blank vote summary card and pulls it in to print the header. If the user holds the vote summary card too tightly, thus preventing the rollers in the printer from effectively grabbing the card, the header may be improperly printed. The user or operating manual should caution users to properly insert the vote summary card gently, release it and allow the printer rollers to take control of the card.

Toolbox

The ES&S Toolbox software application is a stand-alone supplement to the ElectionWare voting system. The Toolbox provides the following functions: creating audio files through a text-to-speech interface, and creating test decks using a 1-2-3 pattern. BVSC conducted a cursory review of Toolbox's features.

Findings:

BVSC found no anomalies.

Source Code Review

ES&S submitted several source code revisions during certification testing after BVSC found several issues related to either security or operational issues. BVSC checked the various source code versions and also examined them with the Klocwork static source code analysis tool. BVSC determined that the latest version, EVS 4.5.0.0, Version 4, which was submitted on February 10, 2015, posed no significant safety, security, or operational risks.

Continuous Improvement & Recommendations

During the extensive period of testing and modifications, BVSC identified several areas affecting usability and functionality that warrant enhanced documentation, procedures, poll worker and staff training, or refinements to the system, procedures, or peripherals.

BVSC makes the following recommendations for the proposed certification of the *EVS Release 4.5.0.0, Version 4* voting system, and/or provisional approval or extension of the provisional approval of the ExpressVote component, to enhance the use of this voting system in its current version, if certified, and to improve the voting system (including ExpressVote) in this and future releases:

1. In order for certification of the *EVS Release 4.5.0.0, Version 4* voting system to be granted, or for provisional approval of the ExpressVote component to be granted, the vendor should revise the user manual and other documentation[32]:
    a. To specify more clearly how a user may test the functionality of the DS200 accommodating the autumn Daylight Saving time change.
    b. To direct the user to generate voter instructions and other ballot style content from the source fields, rather than to enter them manually in the style sheets.
    c. To specify more clearly the programming of Style Sheets with multiple ExpressVote cards.
    d. To advise ExpressVote users to implement explicit procedural controls when selecting contests and verifying ballot styles in ElectionWare.
    e. To caution ExpressPass users to insert the vote summary card carefully into the ExpressPass printer so as to prevent misprints.
2. Certification of future upgrades or enhancements to the *EVS Release 4.5.0.0, Version 4* voting system, or for extension of the provisional approval of the ExpressVote component, if granted, should be conditioned upon the vendor:

[32] Items 1.a.-1.e. have been satisfactorily addressed. ES&S submitted appropriately updated manuals/documentation which were deemed by BVSC to be acceptable short term solutions to the listed items.

a. Eliminating the risk of errors in contest selection while programming an election.

b. Programming a user warning and/or confirmation dialog box in ElectionWare whenever text is used, rather than data fields, to generate the ballot styles. This is to prevent discrepancies between voter instructions and "vote for" numbers.

c. Improving the ballot card list order to be consistent, so that the first card and subsequent cards in a multi-card election appear in consistent order on the ExpressVote ballot style selection screen.

d. Enhancing the ExpressVote multi-card voting functionality to prevent voting of the same card more than once by the same voter.

e. Modifying the option to disable the AutoCast feature, which is currently a setting at the unit level (on each ExpressVote) so that it can be optionally overridden by a universal disable setting at the election definition level (in ElectionWare).

Conclusion

The BVSC recommends certification of *EVS Release 4.5.0.0, Version 4* voting system and provisional approval of the ExpressVote ballot marking device component as follows:

Certification of *EVS Release 4.5.0.0, Version 4* voting system

The BVSC recommends certification for *EVS Release 4.5.0.0, Version 4* voting system, except for the ExpressVote component (which is discussed in the following section), provided the vendor makes beforehand the necessary changes to its written documentation to reflect BVSC recommendations set forth in paragraph 1 under the subsection entitled "Continuous Improvement & Recommendations" for greater specificity, clarity, and guidance regarding use of the system. [33]

Provisional Approval of ExpressVote Ballot Marking Device

The ES&S ExpressVote represents new technology in a voting system specifically for use by Florida voters with disabilities. For example, the system introduces a vote summary card (in lieu of a traditional ballot card) upon which is imprinted only the voter's selections in all contests on a ballot, all contest titles and a corresponding barcode to be "read" by the tabulator. However, in its current form, BVSC has identified several areas affecting usability and functionality that warrant enhanced documentation, procedures, training guidance, or refinements to the system. BVSC finds that with future enhancements, the ExpressVote component could provide greater independence for persons with disabilities.

Therefore, BVSC recommends provisional approval of the ExpressVote ballot marking device for use in any election conducted through May 1, 2017, with the ExpressVote ballot marking device to be used solely by persons with disabilities. The approval should be conditioned upon the vendor first making the necessary changes to its written documentation to reflect BVSC recommendations set forth in paragraph 1 under the subsection entitled "Continuous Improvement and Recommendations" for greater specificity, clarity, and guidance regarding use of the system.[34] The use of the ExpressVote ballot marking device, if approved, is also subject, before use in any election, to future revisions to Rule 1S-2.032, F.A.C., to provide

[33] ES&S has satisfactorily completed EVS Release 4.5.0.0. Version 4 manual updates/documentation requirements.

[34] ES&S has satisfactorily completed manual updates/documentation requirements as related to the ExpressVote ballot marking device.

standards for the accessible audio-visual onscreen display of the ballot and the printed vote summary card in accordance with section 101.5608(3), Florida Statutes. Finally, BVSC does not recommend an extension of this provisional approval, if granted, or recommend the approval of any future release of this ExpressVote ballot marking device unless the issues in paragraph 2 of the Continuous Improvements/Recommendations section of this report are addressed or are no longer an issue. [35]

[35] Any user who uses this system, if certified, is advised to take note of the recommendations herein to develop and implement procedures and provide explicit training to qualified personnel to minimize the potential risks or errors identified in this report, particularly as follows:

a. Add procedural controls and safeguards when selecting ExpressVote contests and verifying ballot styles.
b. Train election officials explicitly to only use the ExpressPass and ExpressPass printer to minimize potential issues mentioned in paragraph 2.c. & d.
c. Ensure proper cleaning and re-assembly of the scanners.
d. Implement quality control procedures to reduce the scanning of worn ballots that could cause jams.
e. Use care when entering data in the various name fields of ElectionWare, as well as when verifying ballot styles, due to the ExpressVote source fields and its truncating behavior.
f. Take into consideration when calculating the quantities of ExpressPass printers to acquire, and when developing their security and operational procedures, that the ExpressPass printer only prints one vote summary card at a time.
g. Use care when inserting vote summary cards into the ExpressPass printer.

Appendices

Appendix A – Acronyms

ADA	Americans with Disabilities Act
BVSC	Bureau of Voting Systems Certification
CF	Compact Flash (memory cards)
COTS	Commercial off the Shelf (software/hardware)
dB	Decibels
EAC	U.S. Elections Assistance Commission
ECO	Engineering Change Order
EMS	Election Management System
ERM	Election Reporting Module
ES&S	Elections Systems & Software, LLC
EVS	ElectionWare Voting System
F.S.	Florida Statutes
FVSS	Florida Voting Systems Standards
GB	Gigabytes
HAVA	Help America Vote Act
HDD	High Density Drive
LAN	Local Area Network
L&A	Logic and Accuracy (voting system test)
MB	Megabytes
PPP	Presidential Preference Primary election
TDP	Technical Data Package
USB	Universal Serial Bus
VAT	Voter Assist Terminal
VVSG	Voluntary Voting Systems Guidelines
VSTL	Voting Systems Test Laboratory
XML	eXtensible Markup Language

Appendix B – Application Timeline Table

ACTION	SYSTEM/VERSION	DATE RECEIVED/REQUESTED
Original application	EVS 4.5.0.0, Version 2	12/09/2013
Modification (1) Request/Requirement	EVS 4.5.0.0, Version 2	02/07/2014
Modification (2) Request/Requirement	EVS 4.5.0.0, Version 2	04/08/2014
Modification (3) Request/Requirement	EVS 4.5.0.0, Version 2	04/16/2014
Modification (4) Request/Requirement	EVS 4.5.0.0, Version 2	04/18/2014
Modification (5) Request/Requirement	EVS 4.5.0.0, Version 2	05/08/2014
Testing was suspended July -November 2014 by mutual agreement		
Modification (6) Request/Requirement	EVS 4.5.0.0, Version 3	12/12/2014
Modification (7) Request/Requirement	EVS 4.5.0.0, Version 4	02/06/2015

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Florida Department of State

KEN DETZNER

Secretary of State